

EMISSION FACTOR DOCUMENTATION FOR

AP-42 SECTION 2.4

MUNICIPAL SOLID WASTE LANDFILLS

REVISED

Office of Air Quality Planning and Standards  
Office of Air and Radiation  
U.S. Environmental Protection Agency  
Research Triangle Park, North Carolina 27711

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## 1.0 INTRODUCTION

The document "Compilation of Air Pollutant Emission Factors" (AP-42) has been published periodically by the U.S. Environmental Protection Agency (EPA) since 1972. New emission source categories and updates to existing emission factors to supplement the AP-42 have been routinely published. These supplements are in response to the emission factor needs of the EPA, State, and local air pollution control programs, and industry.

An emission factor relates the quantity (weight) of pollutants emitted from a unit source. The emission factors presented in AP-42 can be used to:

Estimate area-wide emissions;

- ▼ Estimate emissions for a specific facility; and
- ▼ Evaluate emissions relative to ambient air quality.<sup>1</sup>

The purpose of this report is to provide background information on municipal solid waste (MSW) landfills, the test reports reviewed and used to calculate emission factors, and the models presented in the AP-42 for the estimating of emissions from MSW landfills. This report was revised during the summer of 1997 in order to incorporate additional test data gathered by EPA since the original report was published.

Including the introduction (Chapter 1), this report contains five chapters. Chapter 2 gives a description of MSW landfills. It includes a characterization of the industry, an overview of the different process types, a discussion of emission sources, and a description of the technology used to control emissions resulting from MSW landfills. Chapter 3 is a review of emissions data collection and analysis procedures. The methodology adapted to develop this AP-42 is presented in Chapter 3, including the discussion of the literature search, emission data reports screening, the quality rating system used for test reports and emission factors, and the data used. Chapter 4 describes the pollutant emission factor development, review the data utilized, discusses the protocol methodology, and presents the results of the analysis. Chapter 5 presents AP-42 Section 2.4, Municipal Solid Waste Landfills.

## REFERENCES FOR CHAPTER 1.0

1. U. S. Environmental Protection Agency. Technical Procedures for Developing AP-42 Emission Factors and Preparing AP-42 Sections. Office of Air and Radiation. Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina. March 6, 1992. p. 6.

## 2.0 INDUSTRY DESCRIPTION

A MSW landfill unit means a discrete area of land or an excavation that receives household waste and that is not a land application unit, surface impoundment, injection well, or waste pile.<sup>1</sup> A MSW landfill unit may also receive other types of wastes, such as commercialized solid waste, nonhazardous sludge, and industrial solid waste.<sup>1</sup> Studies conducted by the EPA and State authorities have shown that MSW landfills release air pollutants that may have adverse effects on both public health and welfare. The EPA has proposed that MSW landfills be listed as a source category that causes or contributes to air pollution that endangers public health or welfare.<sup>2</sup> Municipal solid waste landfill emissions, often collectively called landfill gas (LFG), consist primarily of methane (CH<sub>4</sub>) and carbon dioxide (CO<sub>2</sub>) (roughly 50 percent of each), with trace amounts of more than 100 non-methane organic compounds (NMOCs) such as ethane, toluene, and benzene.<sup>2</sup> In the United States, approximately 57 percent of municipal solid waste is landfilled, 16 percent is incinerated, and 27 percent is recycled or composted.<sup>3</sup>

### 2.1 CHARACTERIZATION OF THE INDUSTRY

There were an estimated 2,500 active MSW landfills in the United States in 1995.<sup>3</sup> These landfills were estimated to receive 189 million megagrams (Mg) (208 million tons) of waste annually for 1995, with 55 to 65 percent household waste, and 35 to 45 percent commercial waste.<sup>3</sup> The waste types potentially accepted by MSW landfills include (most landfills accept only a few of these categories):

- ▼ MSW;
- ▼ Household hazardous waste;
- ▼ Municipal sludge;
- ▼ Municipal waste combustion ash;
- ▼ Infectious waste;
- ▼ Waste tires;
- ▼ Industrial non-hazardous waste;
- ▼ Conditionally exempt small quantity generator (CESQG) hazardous waste;

- ▼ Construction and demolition waste;
- ▼ Agricultural wastes;
- ▼ Oil and gas wastes; and
- ▼ Mining wastes.<sup>2</sup>

Unlike many other emission source categories (i.e., manufacturing facilities), landfills will generate LFG emissions long after closure (possibly up to 100 years after closure).

## 2.2 PROCESS DESCRIPTION

Landfill design and operation is normally accomplished by one or a combination of three approaches. These approaches are the area method, the trench method, and the ramp method.<sup>2,4</sup> All of these methods utilize a three-step process that consists of spreading the waste, compacting the waste, and covering the waste with soil. The trench and ramp methods are not commonly used, and are not the preferred methods when liners and leachate collection systems are utilized or required by law.

The area fill method entails placing waste on the ground surface or landfill liner, spreading it in layers, and compacting with heavy equipment. Successive layers are added until a depth of 3 to 4 meters (m) [10 to 12 feet (ft)] is reached. A daily soil cover (i.e., on the top and sides) is spread over the compacted waste. The soil cover can come from other parts of the landfill, or be imported from outside the landfill.<sup>2</sup>

The trench method entails excavating daily trenches designed to receive a day's worth of waste. Successive parallel trenches are excavated and filled, with the soil from the excavation being used for cover material and wind breaks.<sup>2,4</sup>

The ramp method is typically employed on sloping land, where waste is spread and compacted in a manner similar to the area method. However, the cover material is generally obtained from the front of the working face (i.e., from the slope) of the filling operation.<sup>2,4</sup>

The basic landfill cell (i.e., unit, structure) is common to all landfilling methods, and is usually designed to accept a day's waste, after which it is closed, compacted, and covered with soil at the day's end. Figure 2-1 illustrates a sectional view of a sanitary landfill that incorporates a ramp design.<sup>2</sup> Generally, the height of a cell is less than 2.4 m (8 ft), and the working face of the cell can extend to the

facility boundaries. Waste densities generally range from 653 to 830 kilograms (kg) per cubic meter ( $\text{m}^3$ ) [1,100 to 1,400 pounds (lbs) per cubic yard ( $\text{yd}^3$ )] after the waste has been compacted, and range from 1,008 to 1,127 kg per  $\text{m}^3$  (1,700 to 1,900 lbs per  $\text{yd}^3$ ) after waste degradation and settling. If site-specific data are not available, a density of 688 kg per  $\text{m}^3$  (1,160 lbs per  $\text{yd}^3$ ) is recommended for compacted waste.<sup>5</sup> Daily cover material and depth requirements may vary from State to State. Most States, however, require that at least a 15 centimeter (cm) (6 inch) cover be applied at the end of each day, and a 0.6 m (2 ft) final cover of material capable of supporting vegetation be applied for a completed landfill.<sup>2</sup>

Modern landfill design often incorporates liners constructed of soil (i.e., recompacted clay) or synthetics (i.e., high density polyethylene), or both to provide an impermeable barrier to leachate (i.e., water that has passed through the landfill), and gas migration from the landfill. Soil liners can reduce permeability to  $10^{-7}$  cm ( $10^{-8}$  inches) per second, and synthetic liners to  $10^{-13}$  cm ( $10^{-14}$  inches) per second.<sup>2</sup>

### 2.3 EMISSIONS

$\text{CH}_4$  and  $\text{CO}_2$  are the primary constituents of LFG, and are produced by microorganisms within the landfill under anaerobic conditions. Carbohydrates from paper, cardboard, etc, which form the major components of refuse, are decomposed initially to sugars, then mainly to acetic acid, and finally to  $\text{CH}_4$  and  $\text{CO}_2$ .<sup>2</sup>

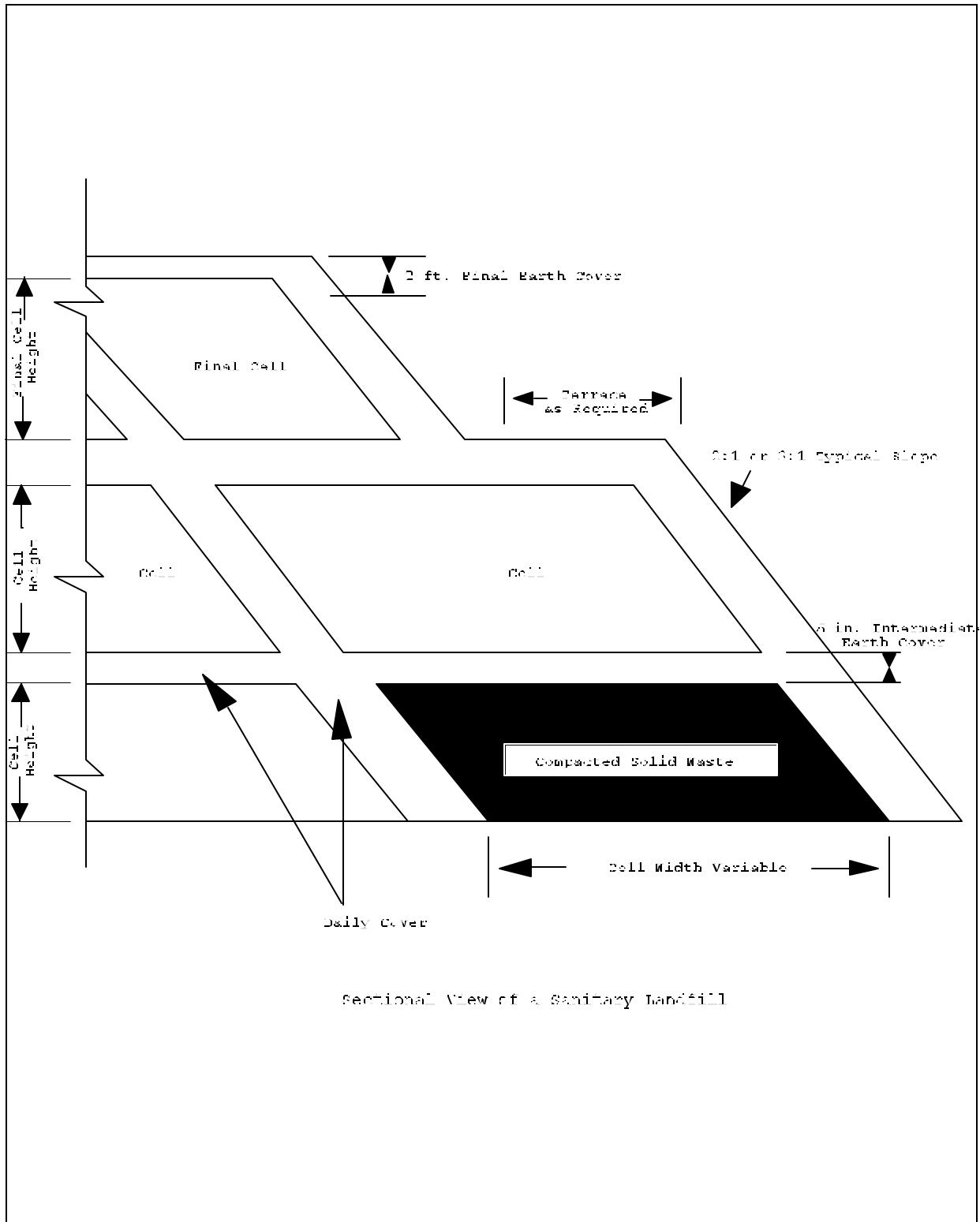


Figure 2-1. Landfill cell design.

Source: Adapted from Reference 2.

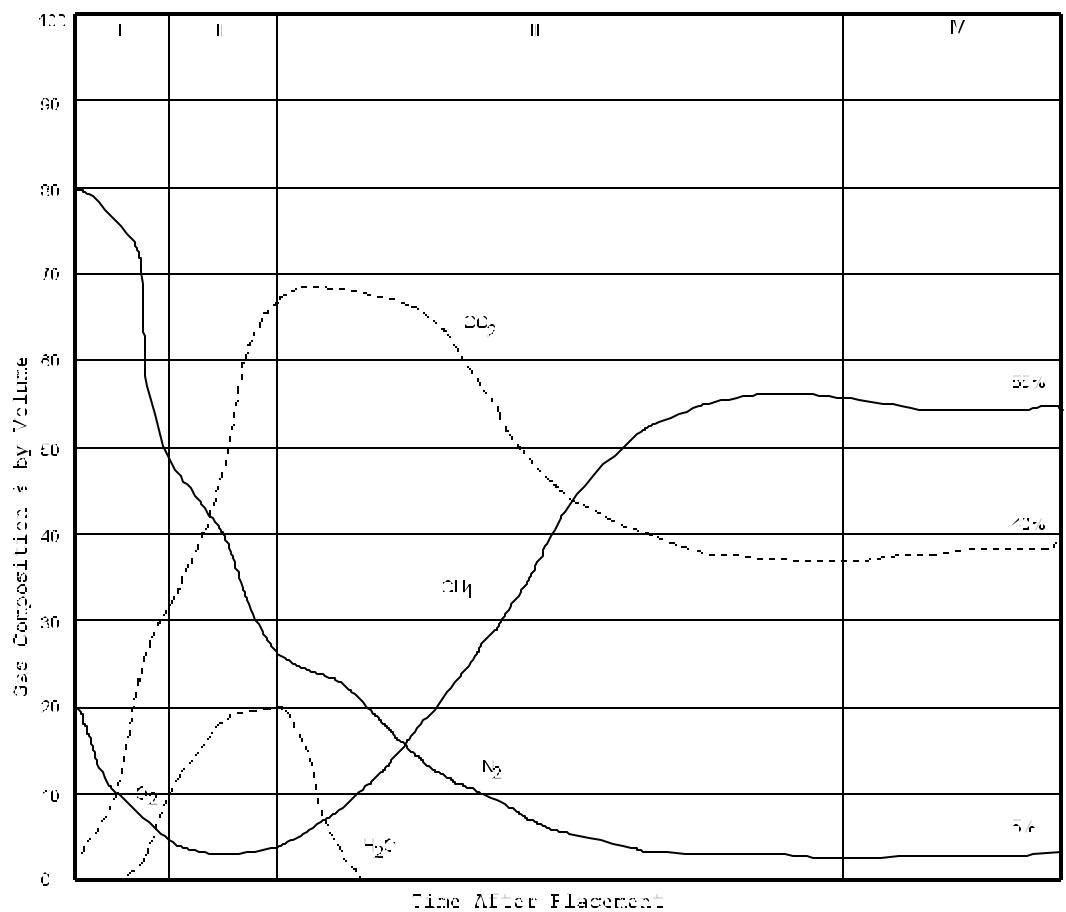
LFG generation, including rate and composition, proceeds through four characteristic phases throughout the lifetime of a landfill. The first phase is aerobic [i.e., with oxygen ( $O_2$ ) available] and the primary gas produced is  $CO_2$ . The second phase is characterized by  $O_2$  depletion, resulting in an anaerobic environment where large amounts of  $CO_2$  and some hydrogen ( $H_2$ ) are produced. In the anaerobic third phase,  $CH_4$  production begins, with an accompanying reduction in the amount of  $CO_2$  produced. Nitrogen ( $N_2$ ) content is initially high in LFG in the aerobic first phase, and declines sharply as the landfill proceeds through the anaerobic second and third phases. In the fourth phase, gas production of  $CH_4$ ,  $CO_2$ , and  $N_2$  becomes fairly steady.<sup>2</sup>

The phase duration and time of gas generation varies with landfill conditions (i.e., waste composition, cover materials, design), and may also vary with climatic conditions such as precipitation rates and temperatures. The modelled evolution of typical LFG is presented in Figure 2-2.2

Emissions of NMOCs result from NMOCs originally contained in the landfilled waste and from their creation from biological processes and chemical reactions within the landfill.<sup>2</sup>

The rates of emissions from landfills are governed by gas production and transport mechanisms. Production mechanisms involve the production of the emission constituent in its vapor phase through vaporization, biological decomposition, or chemical reaction. Production mechanisms are affected by a variety of factors. Vaporization is affected by the concentration of the individual compounds in the landfill, the physical properties of the individual compounds, and the specific landfill conditions (i.e., temperature and confining pressure). Biological decomposition of liquid and solid compounds into other chemical species is dependent upon:

- ▼ The nutrient availability for micro-organisms;
- ▼ Refuse composition;
- ▼ The age of the landfill;
- ▼ Moisture content;



I. Aerobic  
 II. Anaerobic, Non-Methanogenic  
 III. Anaerobic, Methanogenic, Unsteady  
 IV. Anaerobic, Methanogenic, Steady

Note: Time scale (total time and phase duration) of gas generation varies with landfill conditions (i.e., waste composition, and anaerobic state).

Figure 2-2. Evolution of typical LFG.

Source: Reference 2.

- ▼ pH;
- ▼ Temperature;
- ▼ Oxygen availability; and
- ▼ Exposure to biological inhibiting industrial waste.<sup>2</sup>

Quantification of the impacts of any of these factors on LFG production is not possible with the state of current knowledge. Chemical reactions are dictated by the composition of the waste, temperature, and moisture content in the landfills.

Transport mechanisms involve the transportation of a volatile constituent in its vapor phase to the surface of the landfill, through the air boundary layer above the landfill, and into the atmosphere.<sup>2</sup> There are two major transport mechanisms that enable transport of a volatile constituent in its vapor phase: molecular diffusion and biogas convection.<sup>2</sup>

As with production mechanisms, transport mechanisms are affected by a variety of factors. Molecular diffusion through a soil cover is influenced by the soil porosity, the existing concentration gradient, the diffusivity of the constituent, and the thickness of the soil. Molecular diffusion through the air boundary layer is affected by the windspeed, concentration gradient, and diffusivity of the constituent. Biogas convection occurs due to pressure changes within the landfill which are influenced by nutrient availability for bacteria, refuse composition, moisture content, landfill age, temperature, pH, oxygen availability, presence of a gas collection system, and biological inhibiting wastes (i.e., industrial wastes). Displacement due to compaction and settlement is dependent upon the degree of compaction, waste, compatibility, and overburden weight (settlement). Displacement can also occur through other mechanisms. Displacement can be influenced by changes in atmospheric pressure. Displacement due to water table fluctuations is affected by the presence of a liner, rate of evaporation, rate of precipitation, and the horizontal versus the vertical permeability.

## 2.4 CONTROL TECHNOLOGY

The Resource Conservation and Recovery Act (RCRA) Subtitle D regulations promulgated on October 9, 1991, require restrictions on location and operation, design standards, groundwater monitoring, measures of corrective action, closure and post-closure care requirements, and financial

assurance standards for landfills. Under these requirements, the concentration of CH<sub>4</sub> generated by MSW landfills can not exceed 25 percent of the lower explosive limit (LEL) in on-site structures, such as scale houses, or the LEL at the facility property boundary.<sup>1</sup> These regulations took effect on October 9, 1993 and apply to all MSW landfills except those owned and operated by a State or the Federal government.<sup>1</sup>

In addition to RCRA Subtitle D regulations, New Source Performance Standards (NSPS) and Emission Guidelines for air emissions from MSW landfills were promulgated in March of 1996. The standards and guidelines are for non-exempt new and existing landfills. The MSW landfills affected by the NSPS/Emission Guidelines are landfills with actual or design capacities equal to or greater than 2.5 million Mg (2.75 million tons). These include new MSW landfills that began accepting waste on or after May 30, 1991, and existing MSW landfills that have accepted waste since November 8, 1987, or that have capacity available for future use.<sup>2</sup> Regulated under the standards and guidelines are "MSW landfill emissions," which include CO<sub>2</sub>, CH<sub>4</sub>, and NMOCs, some of which are toxic.

The regulation requires that Best Demonstrated Technology (BDT) be used to reduce MSW landfill emissions from affected new and existing MSW landfills emitting greater than or equal to 50 Mg/yr [55 tons per year (tpy)] of NMOCs. The standards require: (1) a well-designed and well-operated gas collection system, and (2) a control device capable of reducing NMOCs in the collected gas by 98 weight-percent. All affected facilities are required to periodically estimate their NMOC emissions rate in order to determine whether collection and control systems are required.<sup>2</sup>

LFG collection systems are either active or passive systems. Active collection systems provide a pressure gradient in order to extract LFG by use of mechanical blowers or compressors. Passive systems allow the natural pressure gradient created by the increased pressure within the landfill from LFG generation to mobilize the gas for collection.<sup>2</sup> The type of gas collection system adopted by a facility is largely dependent upon the landfill characteristics and operating practices. Gas extraction wells may be installed at the landfill perimeter, but are typically installed within the refuse of a landfill. Offsite migration probes are often installed at the landfill perimeter for monitoring the proper operation of the collection system. The depth and spacing of gas extraction wells vary with landfill characteristics and operations (i.e., lined or unlined, waste type, LFG generation, etc.).<sup>2</sup>

The effectiveness of a LFG collection system is also dependent upon its design and operation. Active gas collection systems are generally more efficient than passive gas collection systems.<sup>2</sup> A typical LFG collection system (i.e., typical LFG extraction well and well-field) is illustrated in Figure 2-3.5

LFG control and treatment options include (1) combustion of the LFG, and (2) purification of the LFG. Combustion technique options include those that destroy organics without energy recovery (i.e., flares), and those that recover energy from the destruction of organics (i.e., gas turbines, internal combustion engines, and boiler-to-steam turbine systems).<sup>2</sup> Purification technique options include the use of adsorption, absorption, and membranes to remove water ( $H_2O$ ),  $CO_2$ , and NMOCs. Purification techniques can process raw LFG to pipeline quality natural gas by using adsorption, absorption, and membranes techniques.

Flares involve an open combustion process. Oxygen is usually provided by induction (enclosed flares) or simple mixing (candle flares) of ambient air. The LFG normally enters into a

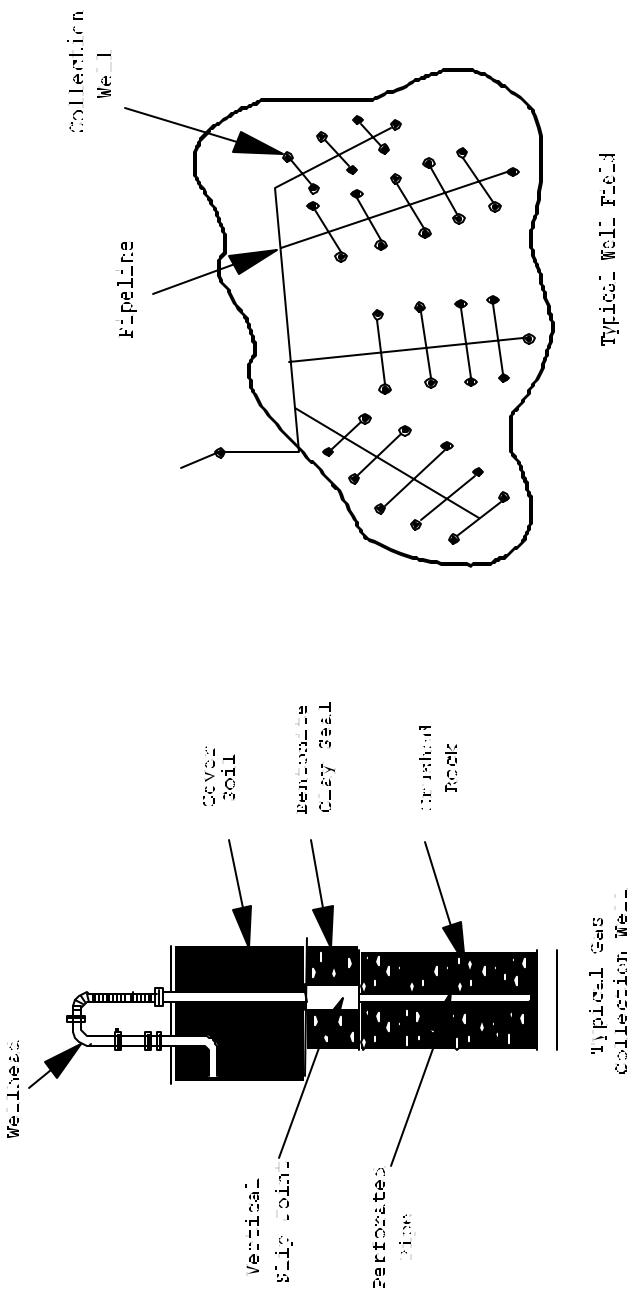


Figure 2-3. Typical TEG collection system.  
Source: Reference 6.

flare collection header and transfer line via one or more blowers. At start-up a purge-gas may also be introduced into the header. The gas then proceeds to the knockout drum, which aids in the removal of condensate formed. The gas then proceeds through a flame barrier (i.e., water seal) prior to flares in order to prevent a flashback from the flares.<sup>2</sup> Flares can be open or enclosed. In an enclosed flare, the quality of combustion is governed by flame temperature, residence time of components in the combustion zone, turbulent mixing within the combustion zone, and the amount of oxygen available for combustion.<sup>2</sup> Figure 2-4 illustrates an example of an enclosed flare design.<sup>2</sup> A process diagram and description are submitted for an enclosed flare because of the prevalence of flare use as a LFG control technique at landfill facilities. Thermal incinerators are used to heat organic chemicals in the presence of sufficient oxygen to a temperature high enough to oxidize the chemical to CO<sub>2</sub> and water. Combustion techniques that recover energy include gas turbines and internal combustion engines that generate electricity from the combustion of LFG.<sup>2</sup> Figure 2-5 is a simplified schematic of a typical gas turbine.<sup>2</sup> Boilers can also be used to recover energy from LFG in the form of steam.<sup>2</sup>

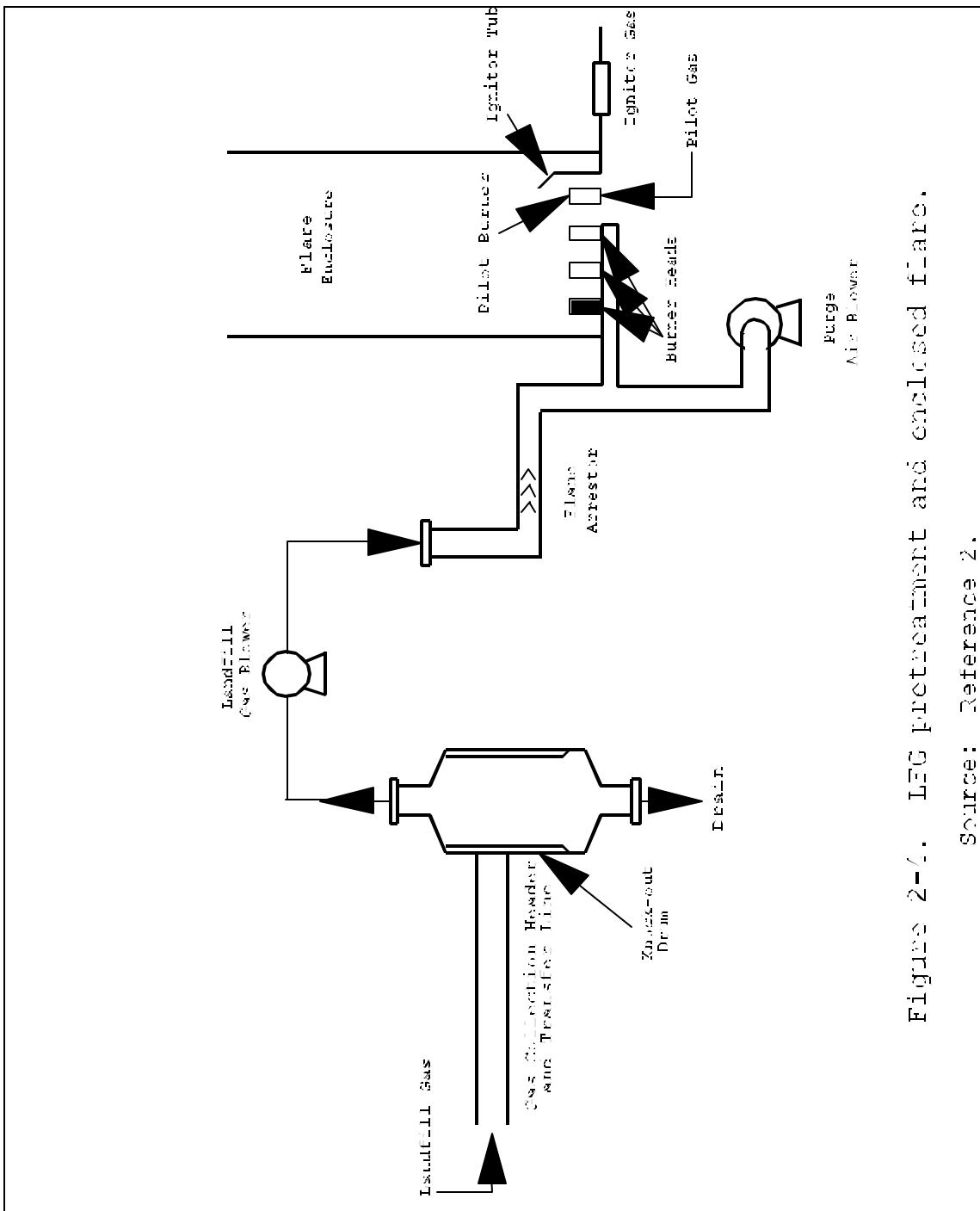


Figure 2-1. LFG pretreatment and enclosed flare.

Source: Reference 2.

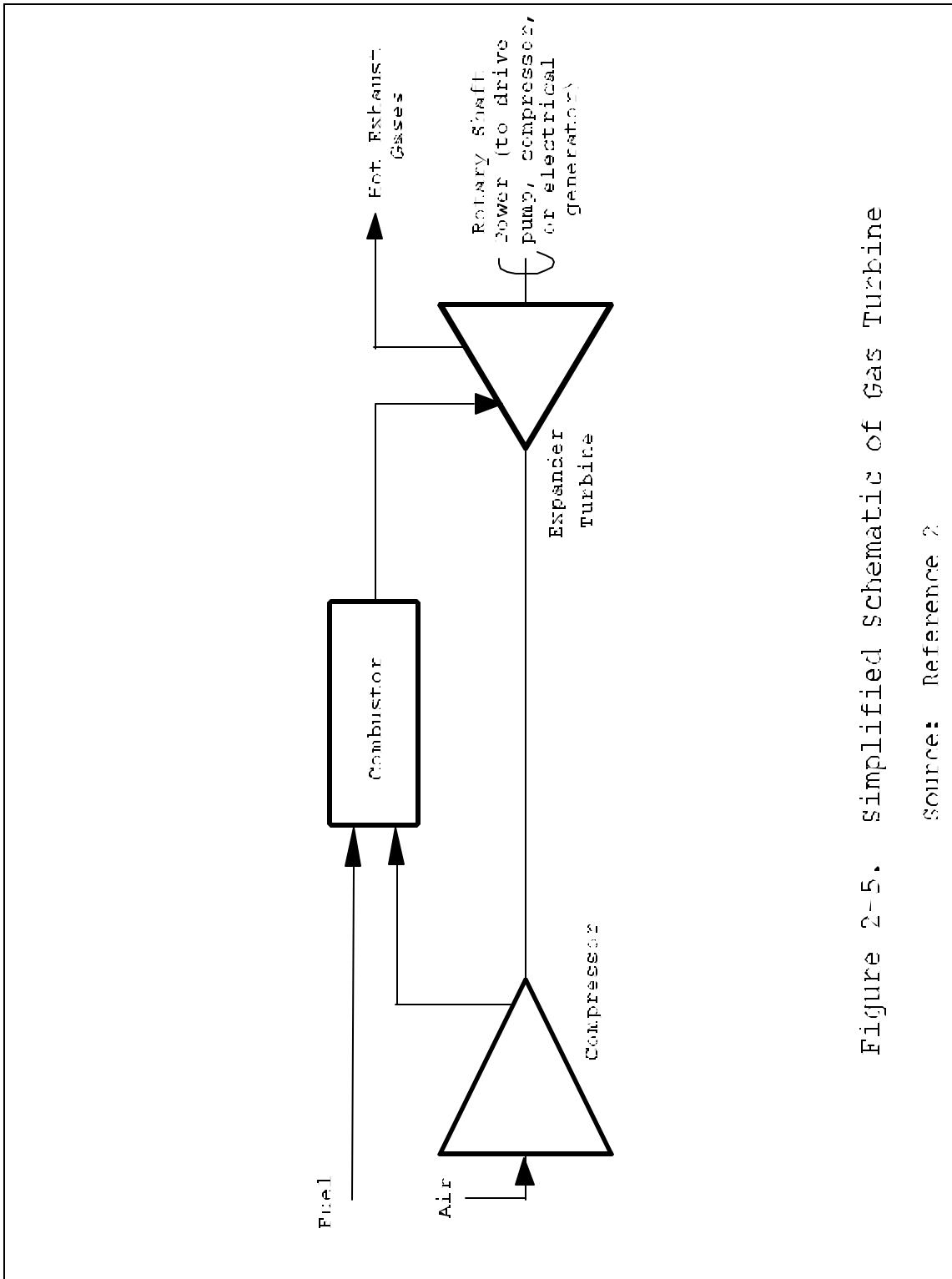


Figure 2-5. Simplified Schematic of Gas Turbine

Source: Reference 2

## REFERENCES FOR CHAPTER 2.0

1. Federal Register. 40 CFR Part 258. Vol. 56, No. 196. October 9, 1991. pp. 50978.
2. U. S. Environmental Protection Agency. Air Emissions from Municipal Solid Waste Landfills - Background Information for Proposed Standards and Guidelines. Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina. March 1991. EPA-450/3-90-011a. Chapter 3 and 4.
3. U. S. Environmental Protection Agency. Characterization of Municipal Solid Waste in the United States: 1996 Update. May 1997. EPA/530-R-97-015.
4. State of California Air Resources Board. Suggested Control Measure for Landfill Gas Emissions. Stationary Source Division, Sacramento, California. August 1990. p. 21-22.
5. U. S. Environmental Protection Agency. Standards of Performance for New Stationary Sources and Guidelines for Control of Existing Sources, Municipal Solid Waste Landfills. Federal Register, Vol. 56, No. 104. May 30, 1991. p. 24469, 24470.
6. Industrial Gas Turbine Systems for Landfill Gas to Energy Projects. Caterpillar Solar Turbines. W. L. Owen.

### 3.0 GENERAL DATA REVIEW AND ANALYSIS PROCEDURES

In the preparation stage for the MSW Landfill AP-42 section, a data gathering task was undertaken. This task included an extensive literature search, contacts to identify ongoing projects within EPA, and electronic database searches. Included in the data gathering was the collection of MSW landfills source test reports. After the data gathering was completed, a review of the information obtained was undertaken to reduce and synthesize the information. The following sections present the general data gathering and review procedures performed in the preparation of the MSW Landfill AP-42 section.

#### 3.1 DATA GATHERING

##### 3.1.1 Literature Search

The literature search conducted for the preparation of this AP-42 section included on-line library system searches of the Office of Research and Development/National Technical Information Service (ORD/NTIS) Database and the NSPS/CTG/CTC database. Information gathered during the preparation of the Proposed Standards and Guidelines (New Source Performance Standards) for MSW landfills was also accessed. This information was available through the EPA's Emission Standards Division, Research Triangle Park, North Carolina. Other information was accessed through the EPA's Air and Energy Engineering Research Laboratory's work on estimating global landfill emissions.

##### 3.1.2 Contacts

Staff within the Emission Standards Division and Air and Energy Engineering Research Laboratory of the EPA with expertise in MSW landfills and testing were sought for their input and technical support, and to provide potential sources of information not already obtained. Telephone contact was also made with Michael Barboza, author of the AP-40 MSW LFG Emissions chapter.

##### 3.1.3 Electronic Database Searches

The Crosswalk/Air Toxics Emission Factors (XATEF), VOC/PM Chemical Speciation (SPECIATE), and the Aerometric Information Retrieval System (AIRS)/Facility Subsystem Emission Factors (AFSEF) electronic databases were searched.

### **3.1.4 Data for the 1995 AP-42 Section Revision**

Additional source test data were incorporated into the AP-42 section analysis from work conducted by EPA's Air and Energy Engineering Research Laboratory (AEERL) during the summer and fall of 1994.<sup>1</sup> Of the 41 source tests reviewed during the AEERL work, data from 18 of these tests were added to the AP-42 database. These 18 tests were selected using the AP-42 guidelines discussed in the following sections. During subsequent peer review, additional source test data were received. The quality of these data were reviewed and the new test data were incorporated as appropriate.

## **3.2 LITERATURE AND DATA REVIEW/ANALYSIS**

Reduction of the literature and data into a smaller, more pertinent subset for development of the MSW Landfill AP-42 section was governed by the following:

- ▼ Only primary references of emissions data were used.
- ▼ Test report source processes were clearly identified.
- ▼ Test reports specified whether emissions were controlled or uncontrolled.
- ▼ Reports referenced for controlled emissions specify the control devices.
- ▼ Data support (i.e., calculation sheets, sampling and analysis description) was supplied in most cases. One exception is that some industry responses to the NSPS surveys were deemed satisfactory for inclusion.
- ▼ Test report units were convertible to selected reporting units.
- ▼ Test reports that were positively biased to a particular situation (i.e., test studies involving PCB analysis because of a known historical problem associated with PCB disposal in an MSW landfill) were excluded.

## **3.3 EMISSION DATA QUALITY RATING SYSTEM**

As delineated by the Emission Inventory Branch (EIB), the reduced subset of emission data was ranked for quality. The ranking/rating of the data was used to identify questionable data. Each data set was ranked as follows:

- A - When tests were performed by a sound methodology and reported in enough detail for adequate validation. These tests are not necessarily EPA reference method tests, although such reference methods were preferred.
- B - When tests were performed by a generally sound methodology, but lack enough detail for adequate validation.
- C - When tests were based on an untested or new methodology or are lacking a significant amount of background data.
- D - When tests were based on a generally unacceptable method but the method may provide an order-of-magnitude value for the source.<sup>2</sup>

The selected rankings were based on the following criteria:

- ▼ Source operation. The manner in which the source was operated is well documented in the report. The source was operating within typical parameters during the test.
- ▼ Sampling procedures. If actual procedures deviated from standard methods, the deviations are well documented. Procedural alterations are often made in testing an uncommon type of source. When this occurs an evaluation is made of how such alternative procedures could influence the test results.
- ▼ Sampling and process data. Many variations can occur without warning during testing, sometimes without being noticed. Such variations can induce wide deviation in sampling results. If a large spread between test results cannot be explained by information contained in the test report, the data are suspect and are given a lower rating.
- ▼ Analysis and calculations. The test reports contain original raw data sheets. The nomenclature and equations used are compared with those specified by the EPA, to establish equivalency. The depth of review of the calculations is dictated by the reviewers' confidence in the ability and conscientiousness of the tester, which in turn is based on factors such as consistency of results and completeness of other areas of the test report.<sup>2</sup>

### 3.4 EMISSION FACTOR DETERMINATION AND RANKING

Once the data were ranked, the selection and determination of data for use in the development of emission factors for uncontrolled and controlled emissions was made. The emission factors developed and presented in the emission factor tables are ranked. The quality ranking ranges from A (best) to E (worst). As delineated by the EIB, the emission factor ratings are applied as follows:

- A - Excellent. Developed only from A-rated source test data taken from many randomly chosen facilities in the industry population. The source category is specific enough to minimize variability within the source population.
- B - Above average. Developed only from A-rated test data from a reasonable number of facilities. Although no specific bias is evident, it is not clear if the facilities tested represent a random sample of the industry. As with the A rating, the source is specific enough to minimize variability within the source population.
- C - Average. Developed only from A- and B-rated test data from a reasonable number of facilities. Although no specific bias is evident, it is not clear if the facilities tested represent a random sample of the industry. As with the A rating, the source category is specific enough to minimize variability within the source population.
- D - Below average. The emission factor was developed only from A- and B-rated test data from a small number of facilities, and there may be reason to suspect that these facilities do not represent a random sample of the industry. There also may be evidence of variability within the source population. Any limitations on the use of the emission factor are footnoted in the emission factor table.
- E - Poor. The emission factor was developed from C- and or D-rated test data, and there may be reason to suspect that the facilities tested do not represent a random sample of the industry. There also may be evidence of variability within the source category population. Any limitations on the use of these factors are always clearly noted.<sup>2</sup>

Emission data quality and emission factor development and ranking according to the discussed methodology in this chapter are presented in more detail in Chapter 4.

## REFERENCES FOR CHAPTER 3.0

1. Methodologies for Quantifying Pollution Prevention Benefits from Landfill Gas Control and Utilization, Roe, S.M., et al., EPA-600/R-95-089, U. S. Environmental Protection Agency, Research Triangle Park, North Carolina, July 1995.
2. Technical Procedures for Developing AP-42 Emission Factors and Preparing AP-42 Sections. Final, Emission Inventory Branch. Office of Air and Radiation. Office of Air Quality Planning and Standards. U. S. Environmental Protection Agency, Research Triangle Park, North Carolina, October, 1993.

## 4.0 DEVELOPMENT OF EMISSION ESTIMATION METHODS

The following chapter presents the test data reviewed and the methodology used to develop air pollutant emission factors, default values, and mass balance methods for MSW landfills.

### 4.1 DATA REVIEW

As discussed in Chapter 3.0, data were obtained during literature searches and submittals to EPA and reviewed to identify a reduced subset of emissions data. The reduced data subset was then reviewed and ranked for quality. The references reviewed are listed in the reference section of this chapter.<sup>1-110</sup>

A large number of the data references reviewed for use in deriving emission factors and default values are from compliance test reports submitted to the South Coast Air Quality Management District (SCAQMD) in California. While there may be an inherent data bias because of the disproportionate number of landfill test data being from California, varying controls, waste composition, operation and maintenance levels, and anaerobic states are expected from these compliance tests. Therefore, elimination of SCAQMD compliance data because of a location bias was not done because it was believed that the merit of these data references outweigh their bias. Generally, the compliance test reports are well documented source tests that follow SCAQMD test sampling method and analysis guidelines and are therefore comparable to data based on EPA methods. Other references reviewed were 114 survey responses requested by the U.S. EPA in the development of the New Source Performance Standard (NSPS) for landfills. Most of these survey responses were eliminated from the database due to their lack of supporting data. Those not eliminated had to provide sufficient detail on test methods to be judged adequate for use in emission factor development.

The remaining data references reviewed are research-based data and compliance data for areas outside of Southern California. Research data references were evaluated separately to determine whether an elimination of a data reference was necessary to eliminate an obvious bias. Bias found in some of the research references includes special study cases where optimum conditions may exist, or where a known, unrepresentative landfill waste composition may exist; these references were removed from the data set.

References were also excluded if source processes and/or control status were not clearly identified, or if the data were not convertible to selected reporting units. Illegible documents were also excluded. Table 4-1 presents data references excluded for the above reasons.

For the 1997 revision to the AP-42 Section 2.4, data from the review of an additional 58 source test reports were included. As mentioned in Chapter 3, 41 of these tests were gathered by AEERL.<sup>53-93</sup> An additional 17 test reports were submitted following a peer review of a 1995 draft of the AP-42 section and background report. Data from these reports were included as appropriate.<sup>94-110</sup>

Appendix A presents a summary of the test data used to derive MSW LFG emission factors. As mentioned previously, many of the California test reports were conducted by the SCAQMD as part of a program to monitor controlled emissions of vinyl chloride, toluene, benzene, and other selected compounds. Gas samples were generally collected using a series of evacuated 2-liter (0.5 gallon) gas bulbs. Gas samples were analyzed by gas chromatography and total combustion analysis at the District laboratory.

Once the subset of data were developed (by removing inappropriate data sources), the emissions data were ranked for quality. Quality ranking of the data, as discussed in Chapter 3.0, is presented in Table 4-2. All tests that were assigned as A rating were considered to have used sound testing methodologies with enough detail (i.e., background information) to validate the data. Tests that were assigned a B or C rating were qualified based on the reasoning for that rating. The only D-rated test

Table 4-1. REFERENCE DATA TESTS EXCLUDED

Reference Number*	Criteria for Exclusion
2	Questionable duplication of source tests.
3	Only controlled data used; uncontrolled data represent pretreated gas or gas from peripheral wells.
11	Samples considered invalid.
14	No process description or background information.
16	Sampling method unclear, illegible copy.
21	Pretreated gas.
25	Biased study - microbiological.
28	No data support.
29	Measurements for gas condensate only.
30	Biased - known to be a polychlorinated biphenyl (PCB) containing landfill.
31	Maximum concentrations only.
32	Biased - study after PCB remedial clean-up measures.
34	Composite of test data. Unable to validate.
38-39, 40, 42, 44	Questionnaire responses - reported modeled, duplicate SCAQMD, or poorly supported data.
71-73, 75, 76, 83-87, 89-93, 110	Missing process data - fuel feed rates, fuel composition.
74	No support data.
77	Mixed fuel use.
78-79	Duplicate test data.
80-81, 88	Poorly supported data.
82	Test conducted during non-normal conditions.

\* Reference numbers 33, 35-37, 45-47, and 52 are not reference tests.  
Source: References 1 through 82.

data used to derive emission factors were from survey responses that presented information on specific compounds of interest that were not reported in any other references.

During the latest revision to this document and AP-42 Section, several sources of information were reviewed regarding the presence of mercury (Hg) in LFG.<sup>94-97,103</sup> The results of this analysis are presented in the following section.

## 4.2 RESULTS OF DATA ANALYSIS AND RECOMMENDED USAGE FOR UNCONTROLLED EMISSIONS

Once the data subset was ranked, the data were evaluated for derivation of emission factors and default values. The following sections present equations for estimating emissions from landfills, suggested inputs to the equations (i.e., default values), and the derivation of emission factors for MSW landfills.

### 4.2.1 Estimation Methods for Uncontrolled Emissions

To estimate uncontrolled emissions of the various compounds present in LFG, total LFG emissions must first be estimated. Emissions for the LFG depend on several factors including: (1) the size, configuration, and operating conditions of the landfill; and (2) the characteristics of the refuse such as moisture content, age, and composition. Uncontrolled CH<sub>4</sub> emissions may be estimated for individual landfills by using a theoretical first-order kinetic model of methane production. This method of estimating emissions could result in conservative (i.e., high) estimates of emissions, since it provides estimates of LFG generation and not LFG release to the atmosphere. Some capture and subsequent microbial degradation of organic LFG constituents within the landfill's surface layer is likely to occur, however no data were identified to adequately quantify this process. For the purposes of emission estimation, biodegradation of LFG constituents is assumed to be negligible.

Table 4-2. RANKING OF REFERENCE DATA TESTS

Reference Number	Ranking (A-D)
1	A
3	A - for controlled gas only.
4-6	A
7	C - no process description.
8-12	A
13	B - calculation sheet illegible.
15	A
17-20	A
22-24	A
26-27	A
41	A
43	D - survey response; calculations not included.
48-51	A
53	B - lacking some process data and calculations.
54-55	A
56	C - lacking field data and calculations.
57	B - lacking some process data and calculations.
58	C - lacking field data and calculations.
59-64	A
65	C - calculations not included.
66-69	A
70	C - lacking field data and calculations.
94	C - lacking field data.
95	C - lacking field data.
96	A
97	A
98	A
99	B - lacking calculations.
100	D - summary tables only.
101	D - summary tables only.
102	D - summary tables only.

Table 4-2. RANKING OF REFERENCE DATA TESTS

Reference Number	Ranking (A-D)
103	A
104	A
105	A
106	C - variability in test results
107	A
108	A
109	A

Note: A-rated data were considered to be the best data and are not qualified. B through C-rated data are qualified to identify shortcomings of the data. D-rated data were excluded prior to data ranking. References 34 through 37, 45 through 47, and 52 are background information documents.  
Source: References 1 through 110.

A computer program that uses the theoretical model mentioned above is known as the Landfill Air Emissions Estimation Model (hereafter referred to as “the landfill model”), and can be accessed from the Office of Air Quality Planning and Standards Technology Transfer Network Website (OAQPS TTN Web) in the Clearinghouse for Inventories and Emission Factors (CHIEF) technical area (URL <http://www.epa.gov/ttn/chief>). The landfill model equation is as follows:<sup>45</sup>

$$Q_{CH} = L_0 R \left( e^{-kc} - e^{-kt} \right) \quad (1)$$

where:

- $Q_{CH}$  = Methane generation rate at time  $t$ ,  $\text{m}^3/\text{yr}$ ;
- $L_0$  = Methane generation potential,  $\text{m}^3 \text{ CH}_4/\text{Mg refuse}$ ;
- $R$  = Average annual refuse acceptance rate during active life,  $\text{Mg/yr}$ ;
- $e$  = Base log, unitless;
- $k$  = Methane generation rate constant,  $\text{yr}^{-1}$ ;
- $c$  = Time since landfill closure, yrs ( $c=0$  for active landfills); and
- $t$  = Time since the initial refuse placement, yrs.

Emissions can be converted to English units by multiplying  $Q_{CH_4}$  by 35.31 to obtain  $ft^3/yr$ ,  $L_O$  by 32.0 to obtain  $ft^3 CH_4/ton$ , and  $R$  by 1.1 to obtain tpy.

Site-specific landfill information is generally available for variables  $R$ ,  $c$ , and  $t$ . When refuse acceptance rate information is scant or unknown,  $R$  can be estimated by dividing the refuse in place by the age of the landfill.<sup>45</sup> If a facility has documentation that a certain segment (cell) of a landfill has received only nondegradable refuse, then the waste from this segment of the landfill can be excluded from the calculation of  $R$ . Nondegradable refuse includes, but is not limited to, concrete, brick, stone, glass, plaster, wallboard, piping, plastics, and metal objects. The average annual acceptance rate should only be estimated by this method when there is inadequate information available on the actual annual acceptance rate. [NOTE: Greater precision in emission rates can be achieved with the use of site-specific data and EPA's the landfill model, since the model can compute methane generation based on the age of each landfill segment.]

Values for the variables  $L_O$  and  $k$  must be estimated.

The potential  $CH_4$  generation capacity of refuse ( $L_O$ ) is dependent on the organic (primarily cellulose) content of the refuse and can vary widely [6.2 to 270  $m^3 CH_4/Mg$  refuse (200 to 8670  $ft^3/ton$ )].<sup>45</sup> The value of the  $CH_4$  generation constant ( $k$ ) is dependent on moisture, pH, temperature, and other environmental factors, as well as landfill operating conditions.<sup>45</sup> Site-specific LFG generation constants can be determined with EPA Reference Method 2E.<sup>45</sup>

The landfill model includes both regulatory default values and recommended AP-42 default values for  $L_O$  and  $k$  (see below). The regulatory defaults were developed for regulatory compliance purposes (NSPS and Emission Guideline) and to provide conservative default values on a national basis for the proposed regulation. As a result, the regulatory  $L_O$  and  $k$  default values may not be representative of specific landfills, and may not be appropriate for use in an emissions inventory. Therefore, different  $L_O$  and  $k$  values may be appropriate in estimating emissions for particular landfills.

The use of site-specific data rather than either set of landfill model defaults is preferred. To do this, the landfill operator would need to select an appropriate value of  $L_O$  from the literature and then use EPA Method 2E to determine  $k$ .

Recommended AP-42 defaults include a k value of 0.04/yr for areas receiving more than 25 inches of rainfall per year, and 0.02/yr for dry areas (<25 inches of rainfall per year). These recommendations are based on a comparison of gas-yield forecasts with LFG recovery data.

A default  $L_O$  value of 100 m<sup>3</sup>/Mg (3,530 ft<sup>3</sup>/ton) refuse is recommended for emission inventory purposes.<sup>46</sup> This value is recommended because it provided better agreement of emissions derived from empirical (measured) data to predicted emissions when k was set to 0.04. The results of this comparison are depicted in Table 4-3. It must be emphasized that in order to comply with the NSPS and Emission Guideline, the regulatory defaults for k and  $L_O$  must be applied as specified in the final rule.

When gas generation reaches steady-state conditions, sampled LFG consists of approximately 40 percent CO<sub>2</sub>; 55 percent CH<sub>4</sub>; up to 5 percent nitrogen (and other atmospheric gases due to infiltration from the LFG collection system or sample dilution); and only trace amounts of NMOC (typically, less than 2 percent). Therefore, the estimate derived for CH<sub>4</sub> generation using the landfill model can also be used to estimate CO<sub>2</sub> generation (i.e., CO<sub>2</sub> = 40/55 x CH<sub>4</sub>).<sup>45</sup> The sum of the CH<sub>4</sub>, nitrogen, and CO<sub>2</sub> emissions will yield an estimate of total LFG emissions.

Emissions of NMOCs result from their volatilization in the landfilled waste, and by their creation from biological processes and chemical reactions within the landfill.<sup>45</sup> Test reports gathered during the literature retrieval process provided concentrations of total NMOCs and speciated NMOCs in LFG.

If site-specific data are to be used to develop emission estimates, the concentrations for total NMOC and speciated NMOCs should be corrected for air infiltration. Air infiltration can occur via two different mechanisms: LFG sample dilution and air intrusion into the landfill (i.e., air pulled in from overdraw of the LFG collection system). LFG constituent concentrations should be corrected for sample dilution as described below if the ratio of N<sub>2</sub> to O<sub>2</sub> is less than or equal to 4.0 (i.e., the ratio in ambient air is 3.76). If the ratio is greater than 4.0, then the LFG constituent concentrations should be corrected for air intrusion (also described below).

For the purposes of developing default LFG constituent concentrations, it was assumed that air intrusion was minimal and the data were corrected for sample dilution only. This

Table 4-3.  
COMPARISON OF MODELED AND EMPIRICAL LFG GENERATION DATA<sup>a</sup>

Landfill <sup>b</sup>	Predicted CH <sub>4</sub> (10 <sup>6</sup> m <sup>3</sup> /yr)	Predicted/ Empirical CH <sub>4</sub>	Landfill <sup>b</sup>	Predicted CH <sub>4</sub> (10 <sup>6</sup> m <sup>3</sup> /yr)	Predicted/ Empirical CH <sub>4</sub>
a	37.6	0.68	u	4.62	0.63
b	39.9	0.77	v	10.5	1.44
c	31.8	0.73	w	4.28	0.72
d	49.8	1.51	x	5.62	0.96
e	12.1	0.53	y	2.39	0.44
f	17.3	0.82	z	9.59	1.84
g	23.6	1.28	aa	5.08	1.08
h	8.61	0.49	bb	4.93	1.15
i	14.9	0.93	cc	3.93	0.93
j	14.5	0.94	dd	2.74	1.03
k	14.2	0.96	ee	8.37	3.23
l	7.16	0.50	ff	117	0.83
m	18.0	1.31	gg	14.4	0.58
n	8.57	0.76	hh	23.0	1.44
o	4.56	0.48	ii	29.6	2.19
p	17.4	1.87	jj	19.3	1.47
q	10.2	1.21	kk	22.4	1.71
r	6.95	0.87	ll	41.3	4.00
s	2.29	0.29	mm	7.14	0.81
t	3.49	0.45	nn	1.07	0.29
Average				1.10	
Maximum				3.23	
Minimum				0.29	
Standard Dev.				0.73	

<sup>a</sup> k = 0.04

<sup>b</sup> Landfill names are considered to be confidential.

assumption may have biased the default concentrations slightly high in cases where air intrusion to the landfill was significant. The correction for sample dilution was done by assuming that CO<sub>2</sub> and CH<sub>4</sub>

were the primary (approximately 100percent) constituents of the LFG and using the following equation:

$$C_{P_{cor}} = \frac{C_P (1 \times 10^6)}{C_{CO_2} + C_{CH_4}} \quad (2)$$

where:

C<sub>P<sub>cor</sub></sub> = Sample dilution corrected concentration of the pollutant of interest, P, in LFG, ppmv;

C<sub>P</sub> = Concentration of the pollutant of interest, P, in LFG, (i.e., NMOC as hexane) ppmv;

C<sub>CO<sub>2</sub></sub> = CO<sub>2</sub> concentration in LFG, ppmv;

C<sub>CH<sub>4</sub></sub> = CH<sub>4</sub> concentration in LFG, ppmv; and

1x10<sup>6</sup> = Constant used to maintain pollutant concentration units in ppmv.

In order to correct the constituent concentrations for air intrusion into the landfill, the concentration of N<sub>2</sub> (i.e., C<sub>N<sub>2</sub></sub>) needs to be added to the denominator of equation 2. Values for C<sub>CO<sub>2</sub></sub> and C<sub>CH<sub>4</sub></sub> were available for most landfills.

The Landfill Air Emissions Estimation model contains a regulatory default value for total NMOC expressed as hexane.

However, there is a wide range for total NMOC values from landfills as will be shown in the following section. The regulatory default value for NMOC concentration was developed for regulatory

compliance purposes and to provide for a conservative default value on a national basis. For emission inventory purposes, it is always preferable that site-specific information be taken into account when determining the total NMOC concentration (i.e., NMOC, CO<sub>2</sub>, N<sub>2</sub> and CH<sub>4</sub> sampling and analysis). The derivation of AP-42 default concentrations is described in the following sections.

#### **4.2.2 Derivation of AP-42 Default Concentrations**

Test reports containing speciated NMOC data were reviewed to determine uncontrolled emission concentrations for specific NMOCs. Appendix B presents the speciated test data. As shown in Appendix B, the data also reflect the co-disposal history of the landfill to the extent known. Landfills known to have accepted non-residential wastes and those known to have never accepted non-residential wastes are delineated. For most landfills, the disposal history is unknown. The speciated NMOC concentrations were then adjusted for air infiltration, as described above, based on sample-specific values for CCO<sub>2</sub> and CCH<sub>4</sub> at each landfill.

Summary statistics are also given in Table 4-5 for each compound. These statistics are derived from the average concentrations for each landfill (i.e., a data point is a site average often based on many test results). For each compound, a normality test was performed. A probability (p value) for the normality test statistic of  $<0.05$  indicates that the data are likely not to be normally distributed. For many compounds, the data were found not to be normally distributed. For those compounds where data were normally distributed, the mean was selected as the best estimator of central tendency (default concentration).

For those compounds that were not normally distributed, another statistical assessment was performed to determine if the data were log normally distributed. Data on the concentrations of the following nine compounds were shown to approximate log normal distributions: 1,2-dichloropropane, acrylonitrile, benzene (at co-disposal sites), chlorodifluoromethane, chloroethane, chloroform, dichlorofluoromethane, methyl isobutyl ketone, and methyl mercaptan. For these LFG constituents, the geometric mean was selected as the default concentration. For the remaining constituents with non-normally distributed data, the median of the normal distribution was selected as the default concentration.

Several sources of data on the mercury (Hg) content of LFG were reviewed in order to develop a default concentration for use in AP-42.<sup>94-97,103</sup> The tests that are documented in these sources were performed using a variety of test methods (i.e., sample collection using gold amalgam traps or potassium permanganate solution). In addition, the level of detail in process description was often lacking (i.e., level of gas processing prior to the point of sample collection). In addition, full test reports were often not available. Due to these limitations, the default concentration presented below should be used with caution.

The available Hg data represent information from 14 landfills, however nine of these were represented by a single average concentration. For all 14 landfills, total Hg concentrations in raw LFG (no data were available for making air infiltration corrections) ranged from  $1.27 \times 10^{-5}$  to  $1.49 \times 10^{-3}$  ppmv. The high end of the range is based on data from one landfill. Most of the data showed total Hg concentrations to be in the  $10^{-4}$  to  $10^{-5}$  ppmv range (no speciation data were available for elemental versus organic forms of Hg). The nature of the available data precluded an assessment of default concentration as described above. The arithmetic mean total Hg concentration of all 14 sites was selected as the default ( $2.53 \times 10^{-4}$  ppmv). Although the data are positively skewed by one high test result, this same test is the highest quality data within the data set (i.e., most current and with the best documentation). Therefore, it was not considered to be an outlier (in which case, the median would have been selected as the default).

The ratings assigned to defaults in Tables 4-5 and 4-6 were derived using the criteria below. Additional downward adjustments of one letter were made to defaults where the data was highly variable (i.e., standard deviation greater than twice the default concentration) or based on data that may not be representative of the entire population.

Data Rating	# of Data Points
A	>20
B	10 - 19
C	6 - 9
D	3 - 5
E	<3

#### 4.2.3 Assessment of Default Concentrations for Selected Constituents by Co-Disposal History

An analysis was performed for selected compounds to determine if the default LFG constituent concentrations differed significantly between landfills based on their co-disposal history with non-residential wastes. LFG constituents were selected for analysis based on their potential to be associated with co-disposal of non-residential wastes and the availability of sufficient data. These compounds are presented in Table 4-4. Default concentrations for the remaining LFG constituents are presented in Table 4-5.

Because the majority of the data available for each of the eight constituents selected for analysis are coded as unknown ("U") for their co-disposal history, unequal sample sizes for statistical tests result. Furthermore, tests for normality showed that the concentration data for all of these compounds were not normally distributed. Therefore, nonparametric statistical tests were applied to the data.

The Kruskal-Wallis K-Sample Test was employed to compare the differences between the multiple mean rank scores ( $K=3$ ) for the eight constituents shown in Table 4-4 for which there were sufficient data for analysis. Table 4-4 shows that, of the eight constituents tested, only the benzene data suggest significant differences in the mean rank scores (i.e.,  $p < 0.05$ ). However, along with the Kruskal-Wallis K-Sample Test, the Tukey Multiple Comparisons Test was performed. This technique can be used to

Table 4-4. RESULTS OF NON-PARAMETRIC ANALYSIS

Compound	Co-disposal?	Sample size (N)	P-Value of K-Sample Test Statistic	Two-Sample Test	P-Value of Two-Sample Test Statistic
Benzene	Y	6	0.042	Y vs. N	0.144
	N	5		Y vs. U	0.016
	U	41		N vs. U	0.458
NMOC	Y	5	0.1374	Y vs. UN	0.016
	N	6		Y vs. N	0.121
	U	12		Y vs. U	0.082
Toluene	Y	5	0.1882	N vs. U	0.606
	N	6		Y vs. UN	0.057
	U	45		Y vs. N	0.171
Vinyl chloride	Y	6	0.167	Y vs. U	0.081
	N	5		N vs. U	0.736
	U	42		Y vs. UN	0.075
Trichloroethylene	Y	6	0.2685	---	---
	N	5		---	---
	U	46		---	---
Tetrachloroethene	Y	6	0.436	---	---
	N	8		---	---
	U	45		---	---
1,1,1-Trichloroethane	Y	6	0.8781	---	---
	N	5		---	---
	U	31		---	---
Carbon tetrachloride	Y	4	0.9185	---	---
	N	5		---	---
	U	13		---	---

U = Co-disposal history unknown.

Y = Known to have co-disposal of non-residential wastes.

N = Known to have no co-disposal of non-residential wastes.

Table 4-5. DEFAULT CONCENTRATIONS FOR LFG CONSTITUENTS  
References 1-110

Compound	Molecular Weight	Default Concentration		
		(ppmv)	Data	Rating
1,1,1-Trichloroethane (methyl chloroform) <sup>b</sup>	133.42	0.48	42	B
1,1,2,2-Tetrachloroethane <sup>b</sup>	167.85	1.11	8	C
1,1-Dichloroethane (ethylidene dichloride) <sup>b</sup>	98.95	2.35	31	B
1,1-Dichloroethene (vinylidene chloride) <sup>b</sup>	96.94	0.20	21	B
1,2-Dichloroethane (ethylene dichloride) <sup>b</sup>	98.96	0.41	27	B
1,2-Dichloropropane (propylene dichloride) <sup>b</sup>	112.98	0.18	8	D
2-Propanol (isopropyl alcohol)	60.11	50.1	2	E
Acetone	58.08	7.01	19	B
Acrylonitrile <sup>b</sup>	53.06	6.33	4	D
Bromodichloromethane	163.83	3.13	7	C
Butane	58.12	5.03	15	C
Carbon disulfide <sup>b</sup>	76.13	0.58	8	C
Carbon monoxide <sup>c</sup>	28.01	141	2	E
Carbon tetrachloride <sup>b</sup>	153.84	0.004	22	B
Carbonyl sulfide <sup>b</sup>	60.07	0.49	6	D
Chlorobenzene <sup>b</sup>	112.56	0.25	14	C
Chlorodifluoromethane	86.47	1.30	13	C
Chloroethane (ethyl chloride) <sup>b</sup>	64.52	1.25	25	B
Chloroform <sup>b</sup>	119.39	0.03	22	B
Chloromethane	50.49	1.21	21	B
Dichlorobenzene <sup>d</sup>	147	0.21	2	E
Dichlorodifluoromethane	120.91	15.7	25	A
Dichlorofluoromethane	102.92	2.62	5	D
Dichloromethane (methylene chloride) <sup>b</sup>	84.94	14.3	37	A
Dimethyl sulfide (methyl sulfide)	62.13	7.82	10	C
Ethane	30.07	889	9	C
Ethanol	46.08	27.2	2	E
Ethyl mercaptan (ethanethiol)	62.13	2.28	3	D
Ethylbenzene <sup>b</sup>	106.16	4.61	39	B
Ethylene dibromide	187.88	0.001	2	E

Table 4-5. DEFAULT CONCENTRATIONS FOR LFG CONSTITUENTS  
References 1-110

Compound	Molecular Weight	Default Concentration		
		(ppmv)	Data	Rating
Fluorotrichloromethane	137.38	0.76	27	B
Hexane <sup>b</sup>	86.18	6.57	19	B
Hydrogen sulfide	34.08	35.5	15	B
Mercury (total) <sup>b,e</sup>	200.61	$2.53 \times 10^{-4}$	14	E
Methyl ethyl ketone <sup>b</sup>	72.11	7.09	22	A
Methyl isobutyl ketone <sup>b</sup>	100.16	1.87	15	B
Methyl mercaptan	48.11	2.49	8	C
Pentane	72.15	3.29	17	C
Perchloroethylene (tetrachloroethylene) <sup>b</sup>	165.83	3.73	59	B
Propane	44.09	11.1	21	B
t-1,2-dichloroethene	96.94	2.84	36	B
Trichloroethylene (trichloroethene) <sup>a</sup>	131.38	2.82	57	B
Vinyl chloride <sup>b</sup>	62.50	7.34	53	B
Xylenes <sup>b</sup>	106.16	12.1	40	B

NOTE: This is not an all-inclusive listing of LFG constituents. It is only a listing of constituents for which data were available at multiple sites.

<sup>a</sup> A data point is a single site average which may have been composited from many more source test results (see Appendix B).

<sup>b</sup> Hazardous Air Pollutants listed in Title III of the 1990 Clean Air Act Amendments.

<sup>c</sup> Carbon monoxide is not a typical constituent of LFG, but does exist in instances involving landfill (underground) combustion. Therefore, this default value should be used with caution. Of 18 sites where CO was measured, only 2 showed detectable levels of CO in LFG.<sup>1-51</sup>

<sup>d</sup> Source tests did not indicate whether this compound was the para- or ortho- isomer. The para-isomer is a Title III-listed HAP.

<sup>e</sup> No data were available to speciate total Hg into the elemental versus organic forms

simultaneously compare the means of each pair of groups (i.e., Y and N, N and U).

The results of the Tukey Multiple Comparisons Test suggest that significant differences exist between the means of "Y" sites and the means of "U" or "N" sites for benzene, toluene, and NMOC. The Wilcoxon-Mann-Whitney Two Sample Test was then applied to the paired combinations of "Y", "N", "U", and "UN" (combined data from unknown and no co-disposal sites) for benzene, toluene, and NMOC. As shown in Table 4-4, the results of this test showed that there were significant differences (at the <0.10 level of significance) between "Y" and "U" sites, but not between "Y" and

Table 4-6. UNCONTROLLED CONCENTRATIONS OF BENZENE, NMOC,  
AND TOLUENE BASED ON WASTE DISPOSAL HISTORY

References 1-110

Compound	Molecular Weight	Default Concentration (ppmv)	No. Of Data Points	Emission Factor Rating
Benzene <sup>a</sup>	78.11			
Co-disposal		11.1	6	D
No or Unknown		1.91	46	B
NMOC (as hexane) <sup>b</sup>	86.18			
Co-disposal		2420	5	D
No or Unknown		595	18	B
Toluene <sup>a</sup>	92.13			
Co-disposal		165	5	D
No or Unknown		39.3	51	A

<sup>a</sup> Hazardous Air Pollutants listed in Title III of the 1990 Clean Air Act Amendments.

<sup>b</sup> For NSPS/EG compliance purposes, the default concentration for NMOC as specified in the final rule must be used. For purposes not associated with NSPS/EG compliance, the default VOC content at co-disposal sites = 85% by weight (2060 ppmv as hexane); at No or Unknown sites = 39% by weight (235 ppmv as hexane).

"N" sites. For toluene and NMOC, the "Y" versus "UN" pairing produced even higher statistical differences.

Although these results are based on a limited database, they lead to the following conclusions:

- ▼ No significant differences have been identified in concentrations in LFG of the following compounds regardless of their co-disposal history: trichloroethylene, vinyl chloride, 1,1,1-trichloroethane, carbon tetrachloride, and tetrachloroethylene (perchloroethylene).
- ▼ Benzene, toluene, and NMOC concentrations are significantly different among landfills where (A) it is known that non-residential wastes were accepted in the past, and (B) it is

unknown whether or not non-residential wastes were accepted in the past and where it is known that these wastes were not accepted.

- ▼ Two unique concentrations can be developed for benzene, toluene, and NMOC corresponding to the co-disposal history of the landfill (i.e., one for co-disposal and one for unknown and no co-disposal sites).

Default concentrations for benzene, toluene, and NMOC based on the landfill's co-disposal history are presented in Table 4-6.

As discussed in Chapter 3.0, the default concentrations were rated based on the test series used for their derivation. It should be emphasized that a large number of LFG test reports were from California, and a number of site-specific variables could not be accounted for (i.e., waste composition, landfill size, climatic conditions, etc.).

Another source of uncertainty is the overall representativeness of the samples in terms of their characterization of LFG that would be emitted from an uncontrolled landfill. Most of the samples were taken from LFG collection equipment in such a way as to characterize the inlet stream to a control device (i.e., flare inlet concentrations for determination of destruction efficiency). This location for sample collection may not be representative of the raw landfill gas, since some condensation and compression has often taken place (e.g., water knock-out drums). LFG constituents are often captured to some degree in the LFG condensate which may be treated on-site, reinjected to the landfill, or sent off-site for treatment. LFG constituents for which this issue is of greatest concern are those with higher molecular weights and water solubilities. For the purposes of emission estimation, it is assumed that these losses to condensate are small and that subsequent revolatilization of these constituents (either on- or off-site) will negate any significant overstatement of emissions.

EPA received additional summary data on Tier 2 NSPS/EG NMOC testing at eleven sites outside of California too late for inclusion in this version of the AP-42 section.<sup>111</sup> These data are taken directly from the landfill subsurface and appear to have come from either no or unknown co-disposal sites. The average NMOC as hexane concentration of 557 ppmv agrees well with the default value of 595 ppmv presented in Table 4-6.

#### 4.2.4 Estimation of Uncontrolled Compound-Specific Emissions

Compound-specific emissions can be estimated from the default concentrations presented in Tables 4-5 and 4-6 and the estimated total amount of LFG generated. As mentioned previously, the Landfill model can be used to estimate methane emissions, assuming that the LFG production has

reached steady-state conditions. Data from 12 landfills in seven states were used to derive a default LFG concentration of 55 percent CH<sub>4</sub> and 45 percent CO<sub>2</sub> and other constituents (after adjusting for sample dilution). Based on this assumed composition, emissions of specific LFG constituents can be estimated with the use of the following equation:

$$Q_P = 1.82 Q_{CH_4} + \frac{C_P}{(1 \times 10^6)} \quad (3)$$

where:

Q <sub>P</sub>	=	Emission rate of pollutant P (i.e., NMOC as hexane), m <sup>3</sup> /yr;
Q <sub>CH<sub>4</sub></sub>	=	CH <sub>4</sub> generation rate, m <sup>3</sup> /yr (from the Landfill model);
C <sub>P</sub>	=	Concentration of P in landfill gas, ppmv; and
1.82	=	Multiplication factor (assumes that approximately 55 percent of landfill gas is CH <sub>4</sub> and 45 percent is CO <sub>2</sub> and other constituents).

Emissions can be converted to English units by multiplying both Q<sub>P</sub> and Q<sub>CH<sub>4</sub></sub> by 35.31 to obtain ft<sup>3</sup>/yr. Uncontrolled mass emissions per year of total NMOC (as hexane), CO<sub>2</sub>, CH<sub>4</sub>, and speciated organic and inorganic compounds can be estimated by the following equation:

$$UM_p = Q_p * \left[ \frac{MW_p * P}{R T (1000g/kg)} \right] \quad (4)$$

where:

UMP =	Uncontrolled (total) mass emissions of the pollutant of interest (i.e., NMOC as hexane)(kg/yr);
P =	Ambient pressure, 1 atm assumed;
Q <sub>p</sub> =	Pollutant emission rate, m <sup>3</sup> /yr;
R =	Ideal gas constant, 8.205 x 10 <sup>-5</sup> m <sup>3</sup> -atm/gmol-°K;
T =	Temperature of LFG, °K (i.e., 273 + °C); and
MWP =	Molecular weight of P (i.e., 86.18 for NMOC as hexane), g/gmol;

For this equation, it is assumed that the operating pressure of the system is approximately 1 atmosphere. If the temperature of the LFG is not known, a temperature of 25°C (77°F) is recommended. Emissions can be converted to English units by multiplying UMP by 1.102 x 10<sup>-3</sup> to obtain tpy.

A default weight fraction for volatile organic compounds (VOC) was derived for both No/Unknown co-disposal sites and co-disposal sites. This was done by assuming that a typical landfill generates gas with a composition consistent with the default concentrations in Tables 4-5 and 4-6 (i.e., NMOC at a co-disposal site is present at 2,420 ppmv versus 595 ppmv at No/Unknown sites). In a specific volume of LFG for each type of site, the mass of negligibly reactive compounds was subtracted from the mass of NMOC in order to derive the VOC content. For No/Unknown co-disposal sites, the default VOC content is 39 percent by weight or 235 ppmv as hexane. For co-disposal sites, the default VOC content is 85 percent by weight or 2,060 ppmv as hexane. Extreme caution should be used in the use of these default VOC contents, since they are driven in large part by the default value assumed for ethane (especially the no/unknown co-disposal value). The ethane default concentration (889 ppmv) is based on data from only nine landfills and is the mean value of a distribution with a range of 21.9 to 1,802 ppmv (see Appendix B).

#### 4.3 RESULTS OF DATA ANALYSIS AND RECOMMENDED USAGE FOR CONTROLLED EMISSIONS

Emissions from landfills are typically controlled by installing a gas collection system. The collected gas is combusted through the use of internal combustion engines, flares, turbines, or boilers. Because gas collection systems are not 100 percent efficient in collecting LFG, emissions of uncollected CH<sub>4</sub>, CO<sub>2</sub>, and NMOCs must be estimated. Control (destruction) efficiencies can be used to estimate emissions of non-combusted NMOCs from the control devices. Also, emission factors can be used to estimate emissions of secondary pollutants from control devices.

Background data used to derive default control efficiencies and secondary pollutant emission factors are presented in Appendix C. Similar methods for determination of the best estimate of central tendency to those described above for default concentrations were used for these defaults. In general, when more than three data points were available, the default was selected among the arithmetic mean, the median, and the geometric mean. If fewer than four data points were available, either the arithmetic mean or the median was selected as the default.

A data point can be an average value from a single device or a composite of these averages among multiple similar devices. Data points were composited in this way when devices were known to be identical (i.e., same manufacturer and model number), located at the same site, and fired on the same LFG (i.e., devices were not fired on gas collected from differing sections of the landfill). The only exception to this was for flares. For flares, it was assumed that equipment operation and maintenance was similar among devices and that any differences in LFG composition at a given site were negligible. Given these assumptions, variability in emission rates due to differences in equipment construction at a given site were assumed to be negligible. Another reason for compositing some of the data from devices at the same site was to remove bias that would have resulted due to the preponderance of data received from certain sites.

To estimate controlled emissions of CH<sub>4</sub>, NMOCs, and other constituents in LFG, the collection efficiency of the system must first be estimated. Several factors in the design and operation are influential in determining the collection efficiency. These factors include (1) gas moving equipment capable of handling the LFG at its maximum generation rate; and (2) collection wells and trenches configured so the gas is effectively collected from all areas of the landfill.<sup>45</sup> Reported gas collection efficiencies typically range from 60 to 85 percent, with an average of 75 percent most commonly assumed.<sup>52</sup> Higher efficiencies may be achieved at some sites (i.e., at lined landfills with well-designed

collection systems). If a site-specific collection efficiency is available (i.e., derived from a surface sampling program), it should be used instead of the 75 percent average.

Controlled emission estimates also need to take into account the control efficiency of the control device. Control efficiencies for the combustion of NMOC, halogenated (i.e., chlorinated), and nonhalogenated organics with differing control devices are presented in Table 4-7. A CH<sub>4</sub> control efficiency of 99.9% can be assumed for any well operated and maintained LFG combustion equipment in lieu of a guarantee from an equipment vendor.<sup>112</sup> Emissions from the control devices need to be added to the uncollected emissions to estimate total controlled emissions.

#### 4.3.1 Controlled CH<sub>4</sub>, NMOC, and Speciated Organic Emissions

Controlled CH<sub>4</sub>, NMOC, and speciated organic emissions can be calculated with equation 5. It is assumed that the LFG collection and control system operates 100 percent of the time. Minor durations of system downtime associated with routine maintenance and repair (i.e., 5 to 7 percent) will not appreciably effect emission estimates.<sup>112</sup> Also, control and utilization equipment are often served by back-up flares which limit uncontrolled emissions when the primary combustion device is under repair. The first term in equation 5 accounts for emissions from uncollected LFG, while the second term accounts for emissions of the pollutant that were collected but not combusted in the control or utilization device:

$$CM_P = \left| UM_P * \left( 1 - \frac{\eta_{col}}{100} \right) \right| + \left| UM_P * \frac{\eta_{col}}{100} * \left( 1 - \frac{\eta_{cnt}}{100} \right) \right| \quad (5)$$

where:

CM<sub>P</sub> = Controlled mass emissions of the pollutant of interest, P, kg/yr;

UM<sub>P</sub> = Uncontrolled mass emissions of P, kg/yr (from equation 4 or the Landfill model);

$\eta_{col}$  = Collection efficiency of the LFG collection system, percent; and

$\eta_{cnt}$  = Control efficiency of the LFG control or utilization device, percent.

Emissions can be converted to English units by multiplying both CM<sub>P</sub> and UM<sub>P</sub> by 1.102 x 10<sup>-3</sup> to obtain tpy. The efficiencies of the control devices are presented in Table 4-7. Control efficiencies were calculated using the following equation:

$$\eta_{ext} = \frac{In - Out}{In} * 100 \quad (6)$$

where:

In = Mass rate of compound entering control device; and

Out = Mass rate of compound exiting the control device.

The inlet mass rates are calculated the same way as the controlled or outlet mass emission rates described below.

The emission rate of each compound from the control device was calculated using the following equation:

$$M = \frac{C_c * MW * Q * 60 * 10^{-6}}{22.39} \quad (7)$$

where:

M = mass emission rate, kg/hr;

Q = Volumetric flow rate of exhaust, in dscm/min;

C<sub>c</sub> = Concentration of compound C, in ppmv;

60 = Conversion factor, min/hr;

10<sup>-6</sup> = Conversion factor (ppmv to volume fraction), ppmv<sup>-1</sup>;

22.39 = Standard gas volume, dscm/kgmol.

Table 4-7. CONTROL EFFICIENCIES FOR LFG CONSTITUENTS

Control Device (SCC)	Constituent <sup>a</sup>	Control Efficiency <sup>b</sup> (%)		Data	
		Typical	Range	Points <sup>c</sup>	Rating
Boiler/Steam (50100306)	NMOC	98.0	96-99+	3	D
Turbine (50100406)	Halogenated species	99.6	87-99+	4	D
	Non-Halogenated species	99.8	67-99+	4	D
Flare <sup>d</sup> (50100303)	NMOC	99.2	90-99+	14	B
	Halogenated species	99.2	91-99+	8	C
	Non-Halogenated species	99.7	38-99+	8	C
Gas Turbine (50100305)	NMOC	94.4	90-99+	2	E
	Halogenated species	99.7	98-99+	2	E
	Non-Halogenated species	98.2	97-99+	2	E
IC Engine (50100304)	NMOC	97.2	94-99+	3	E
	Halogenated species	93.0	90-99+	2	E
	Non-Halogenated species	86.1	25-99+	2	E

<sup>a</sup> Halogenated species are those containing atoms of chlorine, bromine, fluorine, or iodine. See sections 4.3.2 and 4.3.3 for methods to estimate emissions of SO<sub>2</sub>, CO<sub>2</sub>, and HCl from control equipment. A control efficiency of 0 should be assumed for mercury.

<sup>b</sup> Background data are given in Appendix C.

<sup>c</sup> Data points are site averages for flares and equipment averages for other equipment that are identical, located at the same site, and fired on the same LFG.

<sup>d</sup> Where information was available on the equipment tested, the data were for enclosed flares. The defaults are assumed to be equally representative of open flares.

Emission factors for secondary compounds exiting a control device are presented in Table 4-8.

These emission factors were calculated by dividing the emission rate of each compound (kg/hr) by the volumetric flow rate of methane (dscm/min) entering the control device. The volumetric flow rate of methane entering the control device was calculated by the following equation:

$$V_{CH_4} = V_{LFG} \left( \frac{C_{CH_4}}{1 \times 10^6} \right) \quad (8)$$

where:

$V_{CH_4}$  = Volumetric flow rate of  $CH_4$ , dscm/min;

$V_{LFG}$  = Volumetric flow rate of LFG, dscm/min; and

$C_{CH_4}$  = Concentration of  $CH_4$  in LFG, ppmv.

Emissions can be converted to English units by multiplying both  $V_{CH_4}$  and  $V_{gas}$  by 35.31 to obtain ft<sup>3</sup>/min.

#### 4.3.2 Controlled Emissions of CO<sub>2</sub> and SO<sub>2</sub>

Controlled emissions of CO<sub>2</sub> and sulfur dioxide (SO<sub>2</sub>) are best estimated using site-specific LFG constituent concentrations and mass balance methods. If site-specific data are not available, data in Tables 4-5 through 4-7 can be used with the mass balance methods that follow.

Controlled CO<sub>2</sub> emissions include emissions from the CO<sub>2</sub> component of LFG (equivalent to uncontrolled emissions) and additional CO<sub>2</sub> formed during the combustion of LFG. The bulk of the CO<sub>2</sub> formed during LFG combustion comes from the combustion of the CH<sub>4</sub> fraction. Small quantities will be formed during the combustion of the NMOC fraction, however, this typically amounts to less than 1 percent of total CO<sub>2</sub> emissions by weight. Also, the formation of CO through incomplete combustion of LFG will result in small quantities of CO<sub>2</sub> not being formed. This contribution to the overall mass balance picture is also very small and does not have a significant impact on overall CO<sub>2</sub> emissions.<sup>112</sup>

Table 4-8. EMISSION FACTORS FOR SECONDARY POLLUTANTS EXITING CONTROL DEVICES

Control Device (SCC)	Pollutant <sup>a</sup>	Emission Rate			No. of Data	
		Minimum	Typical <sup>b</sup>	Maximum	Points <sup>c</sup>	Rating
Flare  (50100410) (50300601)	NO <sub>x</sub>	0.013	0.039	0.077	11	C
	CO	4.1 x 10 <sup>-3</sup>	0.72	1.8	15	C
	PM	0.013	<u>0.016</u>	0.030	5	D
IC Engine  (50100421)	NO <sub>x</sub>	0.15	<u>0.24</u>	0.81	6	D
	CO	0.38	0.45	0.56	5	C
	PM	0.046	0.046	0.046	1	E
Gas Turbine  (50100420)	NO <sub>x</sub>	0.027	0.083	0.17	4	D
	CO	0.092	<u>0.22</u>	0.77	4	E
	PM	0.013	<u>0.021</u>	0.030	2	E
Boiler/Steam Turbine <sup>d</sup>  (50100423)	NO <sub>x</sub>	0.026	0.032	0.045	4	D
	CO	7.4 x 10 <sup>-4</sup>	5.4 x 10 <sup>-3</sup>	0.011	3	E
	PM	6.8 x 10 <sup>-3</sup>	7.9 x 10 <sup>-3</sup>	8.6 x 10 <sup>-3</sup>	3	D

<sup>a</sup> NO<sub>x</sub> is expressed as nitrogen dioxide. PM is total particulate, however based on data from other gas-fired combustion sources, most of the particulate matter will be less than 2.5 microns in diameter. See sections 4.3.2 and 4.3.3 for methods to estimate emissions of SO<sub>2</sub>, CO<sub>2</sub>, and HCl from control equipment.

<sup>b</sup> The arithmetic mean is used as the typical emission rate, unless otherwise denoted. Underlined values indicate the median and double underlined values indicate the geometric mean. Background data and summary statistics are given in Appendix C.

<sup>c</sup> Data points can be averages of identical devices located at the same site (e.g., boilers) and fired on the same LFG. For flares, equipment located at the same site are assumed to be similar and site averages serve as data points.

<sup>d</sup> All source tests were conducted on boilers, however, emission factors should also be representative of steam turbines. Emission rates are representative of boilers equipped with low-NO<sub>x</sub> burners and flue gas recirculation. No data were available for uncontrolled NO<sub>x</sub> emissions.

The following equation which assumes a 100 percent combustion efficiency for CH<sub>4</sub> can be

$$CM_{CO_2} = UM_{CO_2} + \left[ UM_{CH_4} * \frac{\eta_{col}}{100} * 2.75 \right] \quad (9)$$

used to estimate CO<sub>2</sub> emissions from controlled landfills:

where:

- CMCO<sub>2</sub> = Controlled mass emissions of CO<sub>2</sub>, kg/yr;
- UMCO<sub>2</sub> = Uncontrolled mass emissions of CO<sub>2</sub>, kg/yr (from equation 4 or the Landfill Air Emission Estimation Model);
- UMCH<sub>4</sub> = Uncontrolled mass emissions of CH<sub>4</sub>, kg/yr (from equation 4 or the Landfill Air Emission Estimation Model);
- η<sub>col</sub> = Efficiency of the LFG collection system, percent; and
- 2.75 = Ratio of the molecular weight of CO<sub>2</sub> to the molecular weight of CH<sub>4</sub>.

Emissions can be converted to English units by multiplying CMCO<sub>2</sub>, UMCO<sub>2</sub> and UMCH<sub>4</sub> by 1.102 x 10<sup>-3</sup> to obtain tpy.

To prepare estimates of SO<sub>2</sub> emissions, data on the concentration of reduced sulfur compounds within the LFG are needed. The best way to prepare this estimate is with site-specific information on the total reduced sulfur content of the LFG. Often these data are expressed in ppmv as sulfur (S). Equations 3 and 4 should be used first to determine the uncontrolled mass emission rate of reduced sulfur compounds as sulfur. Then, the following equation can be used to estimate SO<sub>2</sub> emissions:

$$CM_{SO_2} = UM_S * \frac{\eta_{col}}{100} * 2.00 \quad (10)$$

where:

- CMSO<sub>2</sub> = Controlled mass emissions of SO<sub>2</sub>, kg/yr;
- UM<sub>S</sub> = Uncontrolled mass emissions of reduced sulfur compounds as sulfur, kg/yr (from eqs. 3 and 4);

- $O_{col}$  = Efficiency of the LFG collection system, percent; and  
 2.00 = Ratio of the molecular weight of SO<sub>2</sub> to the molecular weight of S.

Emissions can be converted to English units by multiplying both CM<sub>S</sub>O<sub>2</sub> and UM<sub>S</sub> by 1.102 x 10<sup>-3</sup> to obtain tpy.

The next best method to estimate SO<sub>2</sub> concentrations, if site-specific data for total reduced sulfur compounds as sulfur are not available, is to use site-specific data for speciated reduced sulfur compound concentrations. These data can be converted to ppmv as S with equation 11. After the total reduced sulfur as S has been obtained from equation 11, then this value can be used in equation 10 to derive SO<sub>2</sub> emissions.

$$C_S = \sum_{i=1}^n C_p * S_p \quad (11)$$

where:

- $C_S$  = Concentration of total reduced sulfur compounds, ppmv as S (for use in equation 3);  
 $C_p$  = Concentration of each reduced sulfur compound, ppmv;  
 $S_p$  = Number of moles of S produced from the combustion of each reduced sulfur compound (i.e., 1 for sulfides, 2 for disulfides); and  
 $n$  = Number of reduced sulfur compounds available for summation.

If no site-specific data are available, a value of 46.9 can be assumed for  $C_S$ . This value was obtained by using the default concentrations presented in Table 4-5 for reduced sulfur compounds and equation 11. It should be noted that the use of this default value will likely underestimate SO<sub>2</sub> emissions since it is not based on all of the reduced sulfur compounds that may be present in LFG.

#### 4.3.3 Hydrochloric Acid [Hydrogen Chloride (HCl)] Emissions

HCl emissions are formed when chlorinated compounds in LFG are combusted in control equipment. The best methods to estimate emissions are mass balance methods that are analogous to those presented above for estimating SO<sub>2</sub> emissions. Hence, the best source of data to estimate HCl emissions is site-specific LFG data on total chloride [expressed in ppmv as the chloride ion (Cl<sup>-</sup>)]. If these data are not available, then total chloride can be estimated from data on individual chlorinated species using equation 12 below. However, emission estimates may be underestimated, since not every

chlorinated compound in the LFG will be represented in the laboratory report (i.e., only those that the analytical method specifies).

$$C_{Cl} = \sum_{p=1}^n C_p * Cl_p \quad (12)$$

where:

- $C_{Cl}$  = Concentration of total chloride, ppmv as  $Cl^-$  (for use in equation 3);
- $C_p$  = Concentration of each chlorinated compound, ppmv;
- $Cl_p$  = Number of moles of  $Cl^-$  produced from the combustion of each chlorinated compound (i.e., 3 for 1,1,1-trichloroethane); and
- $n$  = Number of chlorinated compounds available for summation.

After the total chloride concentration ( $C_{Cl}$ ) has been estimated, equations 3 and 4 should be used to determine the total uncontrolled mass emission rate of chlorinated compounds as chloride ion ( $UM_{Cl}$ ). This value is then used in equation 13 below to derive HCl emission estimates:

$$CM_{HCl} = UM_{Cl} * \frac{\eta_{col}}{100} * 1.03 * \left( 1 - \frac{\eta_{cnt}}{100} \right) \quad (13)$$

where:

- $CM_{HCl}$  = Controlled mass emissions of HCl, kg/yr;
- $UM_{Cl}$  = Uncontrolled mass emissions of chlorinated compounds as chloride, kg/yr (from eqs. 3 and 4);
- $\eta_{col}$  = Efficiency of the LFG collection system, percent;
- 1.03 = Ratio of the molecular weight of HCl to the molecular weight of  $Cl^-$ ; and
- $\eta_{cnt}$  = Control efficiency of the LFG control or utilization device, percent.

Emissions can be converted to English units by multiplying both  $CM_{HCl}$  and  $UM_{Cl}$  by  $1.102 \times 10^{-3}$  to obtain tpy.

In estimating HCl emissions, it is assumed that all of the chloride ion from the combustion of chlorinated LFG constituents is converted to HCl. If an estimate of the control efficiency,  $\eta_{cnt}$ , is not available, then the high end of the control efficiency range for the equipment listed in Table 4-7 should be used. This assumption is recommended so that HCl emissions are not under-estimated.

If site-specific data on total chloride or speciated chlorinated compounds are not available, then a default value of 42.0 ppmv can be used for CCl. This value was derived from the default LFG constituent concentrations presented in Table 4-5. As mentioned above, use of this default may produce underestimates of HCl emissions since it is based on only those compounds for which analyses have been performed. The constituents listed in Table 4-5 are likely not all of the chlorinated compounds present in LFG.

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## 5.0 AP-42 SECTION 2.4

Section 2.4 of AP-42 is presented in the following pages as it would appear in the document.

## Appendix A

### Summary of Test Report Data

The Lotus (APPXAX~.WK3) or Excel (APPXAX~.XLS) Spreadsheet contains the Appendix A information.

## Appendix B

### Background Data for Default LPG Constituent Concentrations

The Lotus 1-2-3 (LFBKAPPB.WK3) or the Excel (LFBKAPPB.XLS) Speradsheet contains the Appendix B information.

## Appendix C

### Background Data for Secondary Pollutant Emission Factors and Control Efficiencies

Appendix C information is contained in the files:

SECOND.XLS (Excel) or SECOND.WK3 (Lotus) - Secondary Pollutant emission factors for flares, boilers, engines and turbines.

LFGVOC~1.XLS (Excel) or LFGVOC~1.WK3 (Lotus) - Derivation of default VOC concentrations for landfill NMOC's.

CONTRO~2.XLS (Excel) or CONTRO~2.WK3 (Lotus) - Development of default control efficiencies for flares, boilers, engines and turbines.

CHLORI~2.XLS (Excel) or CHLORI~2.WK3 (Lotus) - Derivation of Chlorine defaults.

### Appendix A. Summary of Test Report Data

Ref. No.	Landfill Name	Location	Compounds Tested (Uncontrolled)	Control Device	Compounds Tested (Controlled)	Comments
43 34- Confidential		Confidential	TCA 1,1,2,2-Tetra-chloroethane 1,1,2-Trichloroethane 1,1-Dichloroethane 1,1-Dichloroethene 1,2-Dichlorobenzene 1,2-Dichloroethane 1,2-Dichloropropane 1,3-Dichlorobenzene 1,3-Dichloropropane 1,4-Dichlorobenzene 2-Chloroethylvinyl ether Acetone Acrolein Acrylonitrile Benzene Bromodichloromethane Bromoform Bromomethane Butane Carbon dioxide Carbon tetrachloride Chlorobenzene Chlorodibromomethane Chlorodifluoromethane Chloroethane Chloroform Chloromethane Dichlorodifluoromethane Ethanol Ethylbenzene Fluorotrichloromethane Hexane Methane Methyl ethyl ketone Methyl isobutyl ketone Methylene chloride Pentane Propane t-1,2-Dichloroethene Tetrachloroethene Toluene Trichloroethene Vinyl chloride Xylene	Varies-- uncontrolled data only.		
48 Calabasas Landfill	California		TCA Benzene Carbon dioxide Carbon disulfide Carbon monoxide Carbon tetrachloride Carbonyl sulfide Chloroform Dimethyl sulfide Hydrogen sulfide Methane Methyl mercaptan PCE TCE TNMHC Toluene Vinyl chloride	Flare	TCA Benzene Carbon dioxide Carbon disulfide Carbon monoxide Carbon tetrachloride Carbonyl sulfide Chloroform Dimethyl sulfide Hydrogen sulfide Methane Methyl mercaptan PCE TCE TNMHC Toluene Vinyl chloride	Test date 10/9/87. Active landfill; 6 flares, 3 operational day of testing.

### Appendix A. Summary of Test Report Data

Ref. No.	Landfill Name	Location	Compounds Tested (Uncontrolled)	Control Device	Compounds Tested (Controlled)	Comments
49	Scholl Canyon	California	TCA Benzene Carbon dioxide Carbon disulfide Carbon monoxide Carbon tetrachloride Carbonyl sulfide Chloroform Dimethyl sulfide Hydrogen sulfide Methane PCE TCE TNMHC Toluene Vinyl chloride Xylene	Flare	TCA Benzene Carbon dioxide Carbon disulfide Carbon monoxide Carbon tetrachloride Carbonyl sulfide Chloroform Dimethyl sulfide Hydrogen sulfide Methane PCE TCE TNMHC Toluene Vinyl chloride Xylene	Test date 10/15/87. Active landfill, 4 operational flares and 2 standbys. Flare #2 tested.
50	Puente Hills	California	TCA 1,2 Dichloroethane Benzene Carbon dioxide Carbon disulfide Carbon monoxide Carbon tetrachloride Carbonyl sulfide Chloroform Dimethyl sulfide Hydrogen sulfide Methane Methyl mercaptan PCE t-1,2 Dichloroethene TCE TNMHC Toluene Trichloroethane Vinyl chloride Xylene	Turbine/flare	TCA 1,2 Dichloroethane Benzene Carbon dioxide Carbon disulfide Carbon monoxide Carbon tetrachloride Carbonyl sulfide Chloroform Dimethyl sulfide Hydrogen sulfide Methane Methyl mercaptan PCE t-1,2 Dichloroethene TCE TNMHC Toluene Trichloroethane Vinyl chloride Xylene	Test date 12/1/87. Active landfill, tested flare #23 and solar turbine tested.
51	Palos Verdes	California	TCA Benzene Carbon tetrachloride Chloroform Hydrogen sulfide Methane PCE TCE TNMHC Toluene Vinyl chloride Xylene	Flare	TCA Benzene Carbon dioxide Carbon monoxide Carbon tetrachloride Chloroform Hydrogen sulfide Methane PCE TCE TNMHC Toluene Vinyl chloride Xylene	Test date 11/16/87. Inactive landfill, 3 flare stations (flare station 1 not operating day of testing). Flare stations 2 and 3 tested.
53	Altamont	California	1,2-Dichloroethane Benzene Carbon dioxide Carbon tetrachloride Chloroform Ethylene dibromide Methane Methyl chloroform Methylene chloride Nitrogen Oxygen PCE TCA TCE Vinyl chloride	Flare	Carbon dioxide Carbon monoxide NOx Oxygen THC TNMOC	Test date: 4/7/88. O2 determined by BAAQMD Method ST-14. CO2 determined by BAAQMD Method ST-5. NOx determined by BAAQMD Method ST-13A. THC and THMOC determined by BAAQMD Method ST-7. CO determined by BAAQMD Method ST-C.

### Appendix A. Summary of Test Report Data

Ref. No.	Landfill Name	Location	Compounds Tested (Uncontrolled)	Control Device	Compounds Tested (Controlled)	Comments
54	Arbor Hills	Michigan	1,1-Dichloroethane 1,2-Dichloroethane Benzene Carbon disulfide Carbon tetrachloride Carbonyl sulfide Chlorobenzene Chloroform Dimethyl disulfide Dimethyl sulfide Ethylbenzene Ethylene dibromide Hydrogen sulfide Methyl chloroform Methyl mercaptan Methylene chloride PCE TCE Toluene Vinyl chloride Vinylidene chloride Xylenes	Flare	1,1-Dichloroethane 1,2-Dichloroethane Benzene Carbon disulfide Carbon monoxide Carbon tetrachloride Carbonyl sulfide Chlorobenzene Chloroform Dimethyl disulfide Dimethyl sulfide Ethylbenzene Ethylene dibromide HCL Hydrogen sulfide Methyl chloroform Methyl mercaptan Methylene chloride NOx PCB PCE Quartz TCE TNMOC Toluene Vinyl chloride Vinylidene chloride Xylenes Zinc	
55	BFI Facility, Chicopee MA		1,1-Dichloroethane 1,2-Dichloroethane Benzene Benzyl chloride Carbon tetrachloride Chlorobenzene Chloroform Dichlorobenzene Dichloromethane Dimethyl sulfide Ethyl mercaptan Hydrogen sulfide Methyl chloroform Methyl mercaptan PCE TCE Toluene Vinyl chloride Vinylidene chloride Xylene	Flare	1,1-Dichloroethane 1,2-Dichloroethane Benzene Benzyl chloride Carbon monoxide Carbon tetrachloride Chlorobenzene Chloroform Dichlorobenzene Dichloromethane Dimethyl sulfide Ethyl mercaptan HCl Hydrogen sulfide Methyl chloroform Methyl mercaptan NOx PCE TCE Toluene Vinyl chloride Vinylidene chloride Xylene	Test date: 7/15/90. NOx determined by EPA Method 7A.

### Appendix A. Summary of Test Report Data

Ref. No.	Landfill Name	Location	Compounds Tested (Uncontrolled)	Control Device	Compounds Tested (Controlled)	Comments
56	Coyote Canyon	California	1,1-Dichloroethane 1,1-Dichloroethylene 1,2-Dichloroethane Acetonitrile Benzene Benzyl chloride Carbon disulfide Carbon tetrachloride Chlorobenzene Chloroform Dichlorobenzene Dichloromethane Dimethyl disulfide Dimethyl sulfide Ethyl mercaptan Hydrogen sulfide Methane Methyl chloroform Methyl mercaptan PCE Sulfur TCA TCE TGNMO Toluene Vinyl chloride Xylenes	Boiler/Flare	1,1-Dichloroethane 1,1-Dichloroethylene 1,2-Dichloroethane Acetonitrile Arsenic Benzene Benzyl chloride Beryllium Cadmium Carbon disulfide Carbon monoxide Carbon tetrachloride Chlorobenzene Chloroform Chromium Copper Dichlorobenzene Dichloromethane Dimethyl disulfide Dimethyl sulfide Ethyl mercaptan Formaldehyde HCl Hydrogen sulfide Manganese Mercury Methane Methyl chloroform Naphthalene Nickel Nitrogen NOx Oxygen PAH Particulate matter PCE Selenium Sulfur dioxide TCE TGNMO Toluene Total chromium Vinyl chloride Xylenes	Test date: 6/6 -14/91. Tested flare #1. Test results were evaluated separately for Low flow & High flow rate runs. NOx & CO were analyzed using CARB Method 100 (Chamilum & GFC NDIR).
57	Durham Rd.	California	1,2-Dichloroethane Benzene Carbon dioxide Carbon tetrachloride Chloroform Ethylene dibromide Methane Methyl chloroform Methylene chloride Nitrogen Oxygen PCE TCE Vinyl chloride	Flare	1,2-Dichloroethane Benzene Carbon dioxide Carbon tetrachloride Chloroform Ethylene dibromide Methane Methyl chloroform Methylene chloride Nitrogen Oxygen PCE TCE Vinyl chloride	Test date: 9/1/88. O2 and CO2 determined by BAAQMD Method ST-24.
58	Otay	California	Benzene Carbon tetrachloride Chloroform Ethylene dibromide Ethylene dichloride Methyl chloroform Methylene chloride PCE TCE Vinyl chloride	Engine	Benzene Carbon tetrachloride Chloroform Ethylene dibromide Ethylene dichloride Methyl chloroform Methylene chloride PCE TCE Vinyl chloride	Test date: June 87.

### Appendix A. Summary of Test Report Data

Ref. No.	Landfill Name	Location	Compounds Tested (Uncontrolled)	Control Device	Compounds Tested (Controlled)	Comments
59	Rockingham	Vermont	1,1,2,2-Tetrachloroethane 1,1-Dichloroethane 1,2-Dichloroethane Acetone Acrylonitrile Benzene Carbon tetrachloride Chlorobenzene Chloroform Dichlorobenzene Ethyl benzene Methyl chloroform Methyl ethyl ketone PCE Sulfur dioxide TCE Toluene Vinyl chloride Xylenes	Flare	1,1,2,2-Tetrachloroethane 1,1-Dichloroethane 1,2-Dichloroethane Acetone Acrylonitrile Benzene Carbon tetrachloride Chlorobenzene Chloroform Dichlorobenzene Ethyl benzene HCl HF Methyl chloroform Methyl ethyl ketone Methylene chloride NMO PCE Sulfur dioxide TCE TNMOC Toluene Vinyl chloride Xylenes	Test date: 8/9-10/90. SO <sub>2</sub> determined by EPA Method 8.
60	Sunshine Canyon	California	2-Propanol benzene Butane Dimethyl sulfide Ethanol Ethyl benzene Ethyl mercaptan Hydrogen sulfide Methane Methyl mercaptan PCE Phenol Propyl mercaptan TCE Toluene Xylenes	Flare	2-Propanol Butane Carbon monoxide Dimethyl sulfide Ethanol Ethyl benzene Ethyl mercaptan HCl Hydrogen sulfide Methane Methyl mercaptan Nitrogen NOx Oxygen PCE Particulates Phenol Propyl mercaptan SOx TCE TNMOC Toluene Xylenes	Test date: 5/21-22/90. NO <sub>x</sub> & CO were analyzed using CARB Method 100.
61	Pinelands	New Jersey	Methane	Flare	Carbon dioxide Carbon monoxide Methane Oxygen THC TNMOC	Test date: 2/28/92. CO analyzed by EPA Method 10.
62	Greentree	Pennsylvania		Flare	TNMHC Methane NOx	Test date: 4/22-23/92. NO <sub>x</sub> determined by EPA Method. 7D. CH <sub>4</sub> content estimated.
63	Kappa Quarry	Hawaii		Gas Turbine	Carbon monoxide NOx Sulfur dioxide	Test date: 12/28/93. NO <sub>x</sub> & CO were analyzed by EPA Method 20 & 3.

### Appendix A. Summary of Test Report Data

Ref. No.	Landfill Name	Location	Compounds Tested (Uncontrolled)	Control Device	Compounds Tested (Controlled)	Comments
64	Johnston	Rhode Island	Argon Carbon Carbon dioxide Carbon monoxide Ethane Ethene Helium Heptane Hexane Hydrogen Hydrogen sulfide Isobutane Methane n-Pentane Nitrogen NOx Oxygen Propane Propylene TNMHC	IC Engine	Carbon monoxide NOx TNMHC	Test date: 6/4-66/91. Lean combustion. NOx & CO were analyzed by EPA Method 10 & 7E (Chemilume & NDIR).
65	CID	Illinois		Gas Turbine	Carbon monoxide Oxygen	Test date: 8/8/89. EPA Method 101
66	CID	Illinois		Gas Turbine	NOx Oxygen Sulfur dioxide	Test date: 7/12-14/89. EPA Method 20.
67	BFI Facility, Chicopee	MA		IC Engine	Carbon monoxide NOx Oxygen Sulfur dioxide TGNMO	Test date: 121493/ Lean combustion. NOx, SO2 & CO determined by EPA Method 7E, 6C and 10.
68	BFI Facility, Richmond	Virginia		IC Engine	Carbon dioxide NOx Oxygen	Test date: 4/22-23/92. NOx determined by EPA Method 7E. O2 and CO2 determined by EPA Method 3A. No engine description.
69	Arizona St.	California	1,2-Dibromoethane 1,2-Dichloroethane Benzene Carbon tetrachloride Chloroform Methyl chloroform Methylene chloride PCE TCE Vinyl chloride	Flare	1,2-Dibromoethane 1,2-Dichloroethane Benzene Carbon monoxide Carbon tetrachloride Chloroform Methyl chloroform Methylene chloride NOx Particulates PCE TCE TNMHC Vinyl chloride	Test date: 6/25-26/90. Methane content unknown. NOx and CO determined by SDAPCD Method 20.

### Appendix A. Summary of Test Report Data

Ref. No.	Landfill Name	Location	Compounds Tested (Uncontrolled)	Control Device	Compounds Tested (Controlled)	Comments
70	Puente Hills	California	TCA 1,1-Dichloroethane 1,1-Dichloroethene 1,2-Dibromoethane 1,2-Dichloroethane Acetonitrile Benzene Benzyl chloride Carbon disulfide Carbon tetrachloride Carbonyl sulfide Chlorobenzene Chloroform Dimethyl disulfide Dimethyl sulfide Ethyl mercaptan Hydrogen sulfide m-Dichlorobenzene m-Xylenes Methane Methyl mercaptan Methylene chloride o+p Xylene TCE PCE Toluene Vinyl chloride	Boilers	TCA 1,1-Dichloroethane 1,1-Dichloroethene 1,2-Dibromoethane 1,2-Dichloroethane Acetonitrile Benzene Benzyl chloride Carbon disulfide Carbon monoxide Carbon tetrachloride Carbonyl sulfide Chlorobenzene Chloroform Dimethyl disulfide Dimethyl sulfide Ethyl mercaptan Hydrogen sulfide m-Dichlorobenzene m-Xylenes Methane Methyl mercaptan Methylene chloride o+p Xylene NMOC o+p Dichlorobenzene o+p Xylene Sulfur dioxide TCE PCE Toluene Vinyl chloride	Test date: 9/29/93. NOx & CO were analyzed using SCAQMD Method 100.
71	CID	Illinois		Turbine	Carbon Oxygen	Test date: 2/16/90. O2 and CO2 determined by EPA Method 3. TGNMO determined by EPA Method (modified) 25.
72	Tazewell	Illinois		Engine	TGNMO Carbon monoxide TGNMO NO2 Sulfur dioxide	Test date: 2/22-23/90. SO2 determined by EPA Method 6C. NOx determined by EPA Method 7E. CO determined by EPA Method 10A.

### Appendix A. Summary of Test Report Data

Ref. No.	Landfill Name	Location	Compounds Tested (Uncontrolled)	Control Device	Compounds Tested (Controlled)	Comments
73 Scottsville		New York		Engine	1,1,2,2-Tetrachloroethane 1,1,2-Trichloroethane 1,1-Dichloroethane 1,1-Dichloroethene 1,2-Dichloroethane 1,2-Dichloropropene 1,3-Dichloropropene 2'-Chloroethyl vinyl ether Acetone Acrolein Acrylonitrile Benzene Bromodichloromethane Bromoform Bromomethane Carbon monoxide Carbon monoxide Carbon tetrachloride Chlorobenzene Chlorodibromomethane Chloroethane chloroform Chloromethane Dichlorodifluoromethane Ethane Ethylbenzene Fluorotrichloromethane Mercaptans Methyl ethyl ketone Methylene chloride n-Butane n-Hexane n-Pentane NO <sub>2</sub> Particulates Propane Sulfur dioxide TCA Tetra chloroethane TGNMO TNMHC Toluene Trans -1,2-dichloroethene Trichloroethene Vinyl chloride Xylene Carbon monoxide NOx Sulfur dioxide TNMHC	Test date: 5/2/90. Engine No. 2 was used. SO <sub>2</sub> determined by EPA Method 6C. NO <sub>x</sub> determined by EPA Method 7E. CO determined by EPA Method 10A. O <sub>2</sub> and CO <sub>2</sub> determined by EPA Method 3A. Particulates determined by EPA Method 5. VOC was determined by EPA Methods 5040/8240.
74 Tripoli		New York		IC Engine	Carbon monoxide NOx Sulfur dioxide TNMHC	Test date: 4/3-5/89.
75 Oceanside		New York	Hydrogen sulfide	IC Engine	Carbon monoxide NOx Oxygen TNMHC TSP	Test date: 10/6-7/92. NO <sub>x</sub> & CO were analyzed by EPA Method 7E & 10.
76 Dunbarton Rd.	New Hampshire		Carbon dioxide Carbon monoxide Hydrogen Methane Nitrogen Oxygen	IC Engine	Carbon dioxide Carbon monoxide Hydrogen Methane NOx Oxygen	Test date: 6/5/90. NO <sub>x</sub> & O <sub>2</sub> were analyzed by EPA Method 20. CO analyzed by EPA Method 10.
77 Palo Alto	California		1,1-Dichloroethane Acetone Benzene Bromomethane Carbon dioxide Carbon monoxide Ethyl benzene Methane Methylene chloride Nitrogen Oxygen PCE TCE Toluene Xylenes	Engine	Benzene Carbon dioxide Carbon monoxide Methane NOx Oxygen THC TNMOC VOC	Test date: 6/2/93. Engines No. 1 and 2 used. NO <sub>x</sub> , O <sub>2</sub> , CO <sub>2</sub> , CO, and THC were determined by CARB Method 1-100.

### Appendix A. Summary of Test Report Data

Ref. No.	Landfill Name	Location	Compounds Tested (Uncontrolled)	Control Device	Compounds Tested (Controlled)	Comments
78	Northeast	Rhode Island	Carbon dioxide Ethane Hexane Isobutane Isopentane Methane n-Butane Nitrogen Propane	Engine	Carbon dioxide Carbon monoxide Methane NOx Oxygen TNMHC	Test date: 5/25/94. Engine No. 5 used. O2 and CO2 analyzed by EPA Method 3A. NOx analyzed by EPA Method 7E. CO analyzed by EPA Method 10. TNMHC analyzed by EPA Method 18.
79	Johnston	Rhode Island	Argon Carbon Carbon dioxide Carbon monoxide Ethane Ethene Helium Heptane Hexane Hydrogen Hydrogen sulfide Isobutane Methane n-Pentane Nitrogen NOx Oxygen Propane Propylene TNMHC	Engine	Carbon dioxide Carbon monoxide Methane NOx Oxygen THC TNMHC	Test date: 10/9-16/90, and 11/6/90.
80	Bonsal	California		Flare	Carbon monoxide NOx Particulate matter Sulfur dioxide TNMHC TOG	Test date: 4/94. TNMHC determined by EPA Method 25.
81	Hillsborough	California		Flare	Carbon monoxide NOx Particulate matter Sulfur dioxide TNMHC TOG	Test date: 1/94. TNMHC determined by EPA Method 25.
82	Arizona Street	California		Flare	1,2-dibromoethane 1,2-Dichloroethane Benzene Carbon monoxide Carbon tetrachloride Chloroform Methylene chloride NOx Particulates Sulfur dioxide TCA Tetrachloroethene TNMHC Trichloride Trichloroethene Vinyl chloride	Test date: 3/30-4/7/92. NOx and Carbon monoxide analyzed by SDAPCD Method 20.
83	San Marcos	California		Turbine	Carbon dioxide Carbon monoxide NOx Oxygen	Test date: 3/30/93. Engine No. 1 used. SDAPCD Methods 3A and 20.

### Appendix A. Summary of Test Report Data

Ref. No.	Landfill Name	Location	Compounds Tested (Uncontrolled)	Control Device	Compounds Tested (Controlled)	Comments
84 Otay		California	Benzene Dichloromethane Hydrogen chloride Methylene chloride Sulphur Vinyl chloride	Engine	Benzene Carbon dioxide Carbon monoxide Carbon tetrachloride Chloroform Dichloromethane EDB EDC Formaldehyde HCl Hydrogen chloride Methyl chloroform Methylene chloride NOx Oxygen PCE TCE TNMHC Vinyl chloride	Test date: 10/20-22/87.
85 San Marcos		California	Benzene Carbon tetrachloride Chloroform Ethylene dibromide Methylene chloride PCE TCA TCE Vinyl chloride Vinylidene chloride	Turbine	Benzene Carbon monoxide NOx Sulfur dioxide Vinyl chloride Vinylidene chloride	Test date: 6/26-27/89.
87 Puente Hills		California	PCB	Flare	Carbon dioxide Carbon monoxide HCl Methane NOx Oxygen PCDD PCDF Sulfur dioxide TNMHC TOC Water	Test date: Flare No. 11 was used.
88 Spradra		California	1,1-Dichloroethane 1,1-Dichloroethane 1,1-Dichloroethene 1,2-Dichlorobenzene 1,3-Dichlorobenzene 1,4-Dichlorobenzene Acetronitrile Ammonia Benzene Benzyle chloride Carbon dioxide Carbon monoxide Carbon tetrachloride Chlorobenzene Chloroform HCl Methylene chloride NOx Sulfur dioxide TCA Trichloroethene Vinyl chloride Xylenes	Boiler	1,1-Dichloroethane 1,1-Dichloroethane 1,1-Dichloroethene 1,2-Dichlorobenzene 1,3-Dichlorobenzene 1,4-Dichlorobenzene Acetronitrile Benzene Benzyle chloride Carbon monoxide Carbon tetrachloride Chlorobenzene Chloroform Methylene chloride NOx PAH Sulfur dioxide TCA Trichloroethene Vinyl chloride Xylenes	Test date: 7/25/90.

### Appendix A. Summary of Test Report Data

Ref. No.	Landfill Name	Location	Compounds Tested (Uncontrolled)	Control Device	Compounds Tested (Controlled)	Comments	
89 Oxnard		California	Arsenic Beryllium Cadmium Chromium Copper Lead Manganese Mercury Nickel Selenium Zinc	IC Engine	Acenaphthene Acenaphthylene Anthracene Arsenic Benzo(a)anthracene Benzo(a)pyrene Benzo(b)floranthene Benzo(g,h,i)perylene Benzo(k)floranthene Beryllium Cadmium Chromium Chrysene Copper Dibenz(a,h)anthracene Fluoranthene Fluorene Formaldehyde HCl Hydrogen fluoride Indeno(1,2,3-cd)pyrene Lead Manganese Mercury Naphthalene Nickel Phenanthrene Pyrene Selenium Zinc TCA 1,1,2-Trochloroethane 1,1-Dichloroethene 1,1-Dichloroethane 1,2-Dibromoethane 1,2-Dichloroethane 1,2-Dichloropropane 1,4-Dichlorobenzene 1,4-Dioxane 2-Butanone, MEK 2-Hexanone 2-Methyl phenol 3,4-Methyl phenol 4-Methyl-2-Pentanone, MIBK Acetaldehyde Acetone Acrolein Acrylonitrile Benzene Bromodichloromethane Butane Carbon dioxide Carbon disulfide Carbontetrachloride Chlorobenzene Chloroethane Chloroform Chloromethane Chloropicrin Dibromochloromethane Dichlorobenzene Dichloromethane Ethane Ethylbenzene Formaldehyde Hexane Hydrogen sulfide Hydrogen sulfide Methane Pentane Phenol Propane		Test date: 7/23-27/90. PAH determined by CARB Method 429. Formaldehyde determined by CARB Method 430. Metals determined by CARB Method 436. Arsenic determined by CARB Method 423. Chromium determined by CARB Method 425. HCl determined by CARB Method 421. HF determined by EPA Method 13B.
90 Oxnard		California		Engine		Test date: 10/16/90. Benzene determined by CARB Method 422. Formaldehyde, Acrolin, and Acetaldehyde determined by CARB Method 430. Phenol determined by BAAQMD ST-16.	

### Appendix A. Summary of Test Report Data

Ref. No.	Landfill Name	Location	Compounds Tested (Uncontrolled)	Control Device	Compounds Tested (Controlled)	Comments
91 Oxnard		California	Carbon dioxide Carbon monoxide Ethane Hexane Hydrogen sulfide Hydrogen sulfide iso-Butane iso-Pentane Methane n-Butane n-Pentane Nitrogen Oxygen Propane Sulfur	Engine	Styrene TCE Tetrachloroethene Toluene Trichlorofluoromethane Trichlorotrifluoroethane Vinyl chloride Xylenes	Test date: 12/20/90. Hydrocarbons determined by EPA Method 18. O <sub>2</sub> , N <sub>2</sub> , and CO <sub>2</sub> determined by EPA Method 3.

### Appendix A. Summary of Test Report Data

Ref. No.	Landfill Name	Location	Compounds Tested (Uncontrolled)	Control Device	Compounds Tested (Controlled)	Comments
92	Salinas	California		Engine	1,1,2-Trochloroethane 1,1-Dichloroethene 1,1-Dichloroethane 1,2-Dibromoethane 1,2-Dichloroethane 1,2-Dichloropropane 1,4-Dichlorobenzene 1,4-Dioxane 2-Butanone, MEK 2-Hexanone Acenaphthene Acenaphthylene Acetone Acrylonitrile Anthracene Arsenic Benzene Benzo(a)anthracene Benzo(a)pyrene Benzo(b)floranthene Benzo(g,h,i)perylene Benzo(k)floranthene Beryllium Bromodichloromethane Cadmium Carbon disulfide Carbontetrachloride Chlorobenzene Chloroethane Chloroform Chloromethane Chloropicrin Chromium Chrysene Copper Cristobalite Dibenz(a,h)anthracene Dibromochloromethane Dichloromethane Ethylbenzene Fluoranthene Fluorene HCl Hydrogen sulfide Indeno(1,2,3-cd)pyrene Lead Manganese Mercury Naphthalene Nickel Phenanthrene Phenols Phosphorus Pyrene Quartz Selenium Styrene TCA TCE Tetrachloroethene Toluene Trichlorofluoromethane Trichlorotrifluoroethane Tridymite Vinyl chloride Xylenes Zinc Carbon dioxide Carbon monoxide NOx Oxygen THC TNMHC	Test date: 7/31-8/2/90. PAH determined by CARB Method 429. Formaldehyde, Acrolein, and Acetaldehyde determined by CARB Method 430. Metals determined by CARB Method 436. Cadmium determined by CARB Method 424. Chromium determined by CARB Method 425. HCl determined by CARB Method 421. Silica determined by EPA Method 5. PCB determined by EPA Method 608/8080.
93	Newby Island	California				Test date: 2/7-8/90. Active landfill. CARB Method 1-100 was used.

### Appendix A. Summary of Test Report Data

Ref. No.	Landfill Name	Location	Compounds Tested (Uncontrolled)	Control Device	Compounds Tested (Controlled)	Comments
94	Various	Various	1,1-dichloroethane 1,1-dichloroethylene 1,2-dichloroethylene Benzene Chlorobenzene Dichloromethane Hexane Iso-octane Iso-propylbenzene m,p-xylene Methylbenzene Naphthalene Nonane o-xylene Pentane TCA Tetrachloroethene Trichloroethene	Various	1,1-dichloroethane 1,1-dichloroethylene 1,2-dichloroethylene Benzene Carbon dioxide Chlorobenzene Dichloromethane Hexane Iso-octane Iso-propylbenzene m,p-xylene Mercury Methane Methylbenzene Naphthalene Nitrogen Nonane Oxygen o-xylene Pentane TCA Tetrachloroethene Trichloroethene	
95	Minnesota Counties; "Greater Minnesota" and "Twin Cities Metropolitan Area"	Minnesota		Flare	1,1-dichloroethane 1,1-dichloroethylene 1,2-Dichloroethane 1,2-dichloroethylene Carbon dioxide Carbon disulfide Carbon monoxide Carbon tetrachloride Carbonyl sulfide Chlorobenzene Chloroform Dimethyl disulfide Dimethyl sulfide Ethyl mercaptan HAP HCl Hydrogen sulfide Mercury Methane Methyl mercaptan Methylene chloride Nitrogen Nitrogen dioxide NMOC Perchloroethylene PM Sulfur dioxide TCA Trichloroethylene Vinyl chloride	Test date: 7/90 to 5/91, and 1-11/92.
96	Fresh Kills	New York	Mercury			Test date: 11/96. EPA Method 101A and SW-846 Method 7471 were used.
97	Mountaingate	California	PM Antimony Arsenic Barium Beryllium Cadmium Chromium Copper Lead Manganese Mercury Nickel Selenium Silver Thallium Zinc			Test date: 5/18-21/92.

### Appendix A. Summary of Test Report Data

Ref. No.	Landfill Name	Location	Compounds Tested (Uncontrolled)	Control Device	Compounds Tested (Controlled)	Comments
98	Bakersfield	California	NMHC Butane Ethane Methane Pentane Propane	IC Engine	NMHC Butane CO Ethane Methane NOx Pentane PM Propane	Test date 12/4/90.
99	Otay Landfill	California	NMHC	IC Engine	NMHC CO NOx PM	Test date 4/2/91.
100	Penrose	California	NMHC Methane Perchloroethylene Trichloroethylene	IC Engine	NMHC Methane Perchloroethylene Trichloroethylene	Test date 2/24/88.
101	Toyon Canyon	California	1,1,1-Trichloroethylene Benzene Methane Perchloroethylene Toluene Trichloroethylene Xylene	IC Engine	1,1,1-Trichloroethylene Benzene Methane Perchloroethylene Toluene Trichloroethylene Xylene	Test date 3/8/88.
104	Y & S Maintenance	Pennsylvania	CO CO2 Methane NMHC NOx	Flare	CO CO2 Methane NMHC NOx	Test date 12/14/94. NOx was determined by EPA Method 7D.
105	Seneca Landfill	Pennsylvania	CO CO2 Methane NMHC Oxygen	Flare	CO CO2 Methane NMHC NOx	Test date 9/8/93. NOx and NMHC were determined by EPA Methods 7D and 25C, respectively.
106	Wayne Township	Pennsylvania	CO CO2 Methane NMVOC Oxygen	Flare	CO CO2 Methane NMVOC NOx Oxygen	Test date 4/2/96. NOx and NMVOC were determined by EPA Methods 7D and TO-14, respectively.
107	Bethlehem Landfill	Pennsylvania	NMHC	Flare	CO2 NMHC NOx Oxygen	Test date 10/9/96. Oxygen and CO2, NOx, and NMHC, were determined by EPA Methods 3A, 7E, and 18, respectively.
108	Hartford Landfill	Connecticut	NMOC	Flare	CO CO2 Methane NMOC NOx Oxygen SO2 THC	Test date 11/4/93. Oxygen, NOx, CO, SO2, and THC were determined by EPA Methods 3A, 7E, 10, 6C, and 25A, respectively. CO2, NMOC and methane were determined by EPA Method 18.
109	Contra Costa Landfill	California	1,1,1-Trichloroethane 1,2-Dichloroethane Benzene Carbon tetrachloride Chloroform CO CO2 Ethylene dibromide Methane Methylene chloride Nitrogen NMOC Oxygen Tetrachlorethene Trichlorethene Vinyl chloride	Gas Flare	1,1,1-Trichloroethane 1,2-Dichloroethane Benzene Carbon tetrachloride Chloroform CO CO2 Ethylene dibromide Methane Methylene chloride Nitrogen NMOC Oxygen Tetrachlorethene Trichlorethene Vinyl chloride	Test date 3/22/94. EPA Method TO-14 was used.

## Appendix B

### Background Data for Default LPG Constituent Concentrations

The Lotus 1-2-3 (LFBKAPPB.WK3) or the Excel (LFBKAPPB.XLS) Speradsheet was used for the following Appendix B information. Additional information is contained in the Spreadsheet.

## **Appendix B. Default LFG Constituent Concentrations**

N=No Y=Yes N=Unknown\*\* Values that are outlined indicate that data from only one landfill were available

## Appendix B. Default LFG Constituent Concentrations

\* Y=Yes, N=No, U=Unknown\*\* Values that are outlined indicate that data from only one landfill were available.

## **Appendix B. Default LFG Constituent Concentrations**

\* Y=Yes N=No ||=Unknown\*\* Values that are outlined indicate that data from only one landfill were available

**Appendix B. Default LFG Constituent Concentrations**

Reference	Landfill Name	Co-disposal	(Y, N, or U)*	Compound	Raw Concentration (ppm)	Air Infiltration Corrected Conc. (ppm)	Site Ave** (ppm)	Summary Statistics of (ppm)				Site Averages
								8.60	1.82	8.82	0.07	
43	CB11	U	U	1,2-Dichloroethane	0.06	0.02	0.07	Range	1,800	1,820	0.020	
43	CB13	U	U	1,2-Dichloropropane	0.50	0.51	0.07	Maximum	1,820	1,820	3.36	
43	CB14	U	Y	1,2-Dichloropropane	0.27	0.27	0.02	Sum	8,000	8,000	<.05	
43	CB24	U	U	1,2-Dichloropropane	0.22	0.22	0.27	Count				
43	CB27	U	U	1,2-Dichloropropane	0.10	0.10	0.10	Normality Test (p)				
43	CB30	U	U	1,2-Dichloropropane	0.12	0.12	0.10	Geometric Mean				
43	CB5	U	U	1,2-Dichloropropane	0.50	0.50	0.55					
43	CB8	U	U	1,2-Dimethyl cyclohexane	0.50	0.50	0.55					
43	Guadalupe	U	U	1,3-Dimethyl cyclohexane	0.12	0.12	0.12					
43	Guadalupe	U	U	1-Butanone	0.20	0.20	0.25					
43	Guadalupe	U	U	1-Propanol	0.20	0.20	0.20					
43	Guadalupe	U	U	2,4-Dimethyl heptane	10.5	12.6	12.6					
43	Guadalupe	U	U	2-Butanol	13.3	15.9	15.9					
43	CBH5	U	U	2-Chloroethylvinyl ether	2.25	2.27	2.27					
43	Guadalupe	U	U	2-Hexanone	12.6	15.1	15.1					
43	Guadalupe	U	U	2-Methyl heptane	2.10	2.51	2.51					
43	Guadalupe	U	U	2-Methyl propanoate	4.40	5.27	5.27					
43	Guadalupe	U	U	2-Methyl-methylester propanoic acid	5.60	6.71	6.71					
43	Guadalupe	U	U	2-Propanol	6.23	6.23	6.23					
43	Sunset Canyon	U	U	2-Propenoic acid	6.77	6.77	6.77					
43	CBH1	U	U	Acetone	6.77	6.77	6.77					
43	CBH1	U	U	Acetone	12.0	12.1	12.1					
43	CBH12	U	U	Acetone	2.25	2.48	2.48					
43	CBH14	U	U	Acetone	1.84	1.86	1.86					
43	CBH18	U	U	Acetone	4.50	4.59	4.59					
43	CB20	U	U	Acetone	6.50	6.54	6.54					
43	CB21	U	U	Acetone	2.25	2.27	2.27					
43	CB22	U	U	Acetone	19.3	19.5	19.5					
43	CB23	U	U	Acetone	1.00	1.06	1.06					
43	CB24	U	U	Acetone	20.0	20.3	20.3					
43	CB26	U	U	Acetone	6.50	6.54	6.54					
43	CB27	U	U	Acetone	5.33	5.37	5.37					
43	CB31	U	U	Acetone	1.00	1.04	1.04					
43	CB32	U	U	Acetone	7.00	7.01	7.01					
43	CB33	U	U	Acetone	2.50	2.51	2.51					
43	CB6	U	U	Acetone	6.00	8.02	8.02					
43	CB7	U	U	Acetone	7.50	7.55	7.55					
43	CB9	U	U	Acetone	32.0	32.8	32.8					
43	Rockingham	U	U	Acetone	14.0	14.1	14.1					
59	Coyote Canyon	U	U	Acetone	36.8	48.9	48.9					
56	Coyote Canyon	U	U	Acetonitrile	0.023	0.023	0.023					
43	CB14	U	U	Acrylonitrile	0.019	0.019	0.019					
43	CB25	U	U	Acrylonitrile	0.80	0.81	0.81					
43	CB44	U	U	Acrylonitrile	7.40	7.46	7.46					
43	CB45	U	U	Acrylonitrile	9.53	9.58	9.58					
59	Rockingham	U	U	Acetone	21.3	28.3	28.3					
53	Arbor Hills	U	U	Acetone	7.70	8.46	8.46					
53	Arbor Hills	U	U	Acetone	9.91	10.6	10.6					
54	Arbor Hills	U	U	Acetone	0.95	0.98	0.98					
54	Arbor Hills	U	U	Benzene	0.99	1.00	0.96					
54	Arzu Land Reclamation	U	U	Benzene	0.84	0.86	0.86					
15	Arzu Land Reclamation	U	U	Benzene	0.10	0.10	0.10					
15	Arzu Land Reclamation	U	U	Benzene	1.90	1.98	1.98					
15	Arzu Land Reclamation	U	U	Benzene	2.30	2.40	2.40					
15	Arzu Land Reclamation	U	U	Benzene	2.80	2.92	2.92					
15	Arzu Land Reclamation	U	U	Benzene	1.50	1.58	1.58					
15	Arzu Land Reclamation	U	U	Benzene	2.20	2.28	2.28					
15	Arzu Land Reclamation	U	U	Benzene	1.10	1.18	1.18					
12	BKK Landfill	U	U	Benzene	4.10	4.28	4.28					
12	BKK Landfill	U	U	Benzene	96.1	96.1	96.1					
17	Bentley PH	U	U	Benzene	34.0	34.0	34.0					
17	Bentley PH	U	U	Benzene	45.0	45.0	45.0					
17	Bentley PH	U	U	Benzene	2.80	3.47	3.47					
17	Bentley PH	U	U	Benzene	3.10	3.74	3.74					
17	Bentley PH	U	U	Benzene	2.30	3.54	3.54					
17	Bentley PH	U	U	Benzene	1.10	1.38	1.38					
17	Bentley PH	U	U	Benzene	2.60	3.89	3.89					
17	Bentley PH	U	U	Benzene	1.70	1.78	1.78					
14	Bentley PH	U	U	Benzene	0.90	1.10	1.10					
0	Bentley PH	U	U	Benzene	0.70	1.20	1.20					
6	Bentley PH	U	U	Benzene	6.10	7.63	7.63					
6	Bentley PH	U	U	Benzene	6.90	12.3	12.3					
7	Calabasas	U	U	Benzene	18.0	32.5	32.5					
7	Calabasas	U	U	Benzene	11.7	57.8	57.8					
13	Carson	U	U	Benzene	4.20	17.8	17.8					
13	Carson	U	U	Benzene	3.70	6.46	6.46					
13	Carson	U	U	Benzene	5.10	7.85	7.85					

\* Y=Yes, N=No, U=Unknown\*\* Values that are outlined indicate that data from only one landfill were available.

**Appendix B. Default LFG Constituent Concentrations**

Reference	Landfill Name	Co-disposal (Y, N, or U)*	Compound	Raw Concentration (ppmv)	Air Infiltration Corrected Conc. (ppmv)	Site Ave** (ppmv)	Summary Statistics of (ppmv)	Site Averages
43	CB110	U	Benzene	1.00	1.02	1.02	Range 0.205- 0.211	92.306
43	CBH11	U	Benzene	1.97	1.97	1.97	Maximum 180.121	
43	CBH12	U	Benzene	2.80	2.86	2.86	Sum 6.000	
43	CBH13	U	Benzene	2.53	1.85	1.85	Count >20	
43	CBH14	U	Benzene	2.76	2.79	2.79	Normality Test (p) 0.30	11.133
43	CBH15	U	Benzene	0.36	0.35	0.35	Geometric Mean 0.10	
43	CBH16	Y	Benzene	0.30	0.30	0.30	C36 0.56	
43	CBH17	U	Benzene	0.10	0.10	0.10	C50 0.65	
43	CBH18	U	Benzene	0.53	0.55	0.55	C65 1.06	
43	CBP10	U	Benzene	0.65	0.65	0.65	C65 1.06	
43	CBP11	U	Benzene	1.05	1.05	1.05	C65 1.06	
43	CBP12	U	Benzene	0.57	0.58	0.58	C65 1.06	
43	CBP13	U	Benzene	1.20	1.27	1.27	C65 1.58	
43	CBP14	Y	Benzene	0.53	0.51	0.51	Benzene unknown & no grid(S)	
43	CBP15	U	Benzene	2.42	2.44	2.44	Mean 0.15	4.399
43	CBP16	U	Benzene	0.77	0.78	0.78	Median 0.16	1.911
43	CBP17	U	Benzene	79.1	83.7	83.7	Standard Deviation 0.2251	
43	CBP18	U	Benzene	2.65	2.67	2.67	Variance 0.15080	
43	CBP19	U	Benzene	0.60	0.60	0.60	Kurtosis 41.515	
43	CBP21	U	Benzene	0.70	0.70	0.70	Skewness 6.317	
43	CBP22	U	Benzene	0.53	0.53	0.53	Range 0.07	
43	CBP23	U	Benzene	1.69	1.69	1.69	Minimum 0.07	
43	CBP24	U	Benzene	2.55	2.55	2.55	Maximum 0.2745	
43	CBP25	U	Benzene	0.20	0.20	0.20	Sum 0.19778	
43	CBP26	U	Benzene	1.50	1.50	1.50	Count 46,000	
43	CBP27	U	Benzene	4.55	4.55	4.55	Normality Test (p) <.01	
43	CBP29	U	Benzene	1.20	1.20	1.20		
43	CBP30	U	Benzene	0.31	0.31	0.31		
43	CBP31	U	Benzene	0.036	0.15	0.15		
43	CBP32	U	Benzene	0.13	0.37	0.37		
43	CBP33	U	Benzene	0.09	0.26	0.26		
43	CBP34	U	Benzene	0.10	0.29	0.29		
43	CBP35	U	Benzene	0.70	9.36	9.36		
43	CBP36	U	Benzene	3.36	4.57	4.57		
43	CBP37	U	Benzene	0.48	9.17	9.17		
43	CBP38	U	Benzene	1.30	56.7	56.7		
43	CBP39	U	Benzene	0.50	67.9	67.9		
43	CBP40	U	Benzene	20.00	4.36	4.36		
43	CBP41	U	Benzene	1.00	2.30	2.30		
43	CBP42	U	Benzene	5.40	23.5	23.5		
43	CBP43	U	Benzene	0.96	4.19	4.19		
43	CBP44	U	Benzene	0.00	26.2	26.2		
43	CBP45	U	Benzene	87.2	23.5	23.5		
43	CBP46	U	Benzene	5.40	4.19	4.19		
43	CBP47	U	Benzene	0.96	4.80	4.80		
43	CBP48	U	Benzene	1.10	3.12	3.12		
43	CBP49	U	Benzene	53.0	156	156		
43	CBP50	U	Benzene	2.30	2.43	2.43		
43	CBP51	U	Benzene	22.0	2.76	2.76		
43	CBP52	U	Benzene	4.00	6.88	6.88		
43	CBP53	U	Benzene	4.00	6.81	6.81		
43	CBP54	U	Benzene	1.40	3.41	3.41		
43	CBP55	U	Benzene	1.40	3.31	3.31		
43	CBP56	U	Benzene	1.30	2.58	2.58		
43	CBP57	U	Benzene	1.30	2.53	2.53		
43	CBP58	U	Benzene	12.0	15.6	15.6		
43	CBP59	U	Benzene	12.0	16.2	16.2		
43	CBP60	U	Benzene	16.0	21.3	21.3		
43	CBP61	U	Benzene	15.0	15.9	15.9		
43	CBP62	U	Benzene	0.60	9.02	9.02		
43	CBP63	U	Benzene	0.25	8.46	8.46		
43	CBP64	U	Benzene	0.50	10.30	10.30		
43	CBP65	U	Benzene	1.73	1.73	1.73		
43	CBP66	U	Benzene	3.00	6.26	6.26		
43	CBP67	U	Benzene	0.28	0.64	0.64		
43	CBP68	U	Benzene	0.50	1.00	1.00		
43	CBP69	U	Benzene	0.13	0.26	0.26		
43	CBP70	U	Benzene	12.0	23.9	23.9		

\* Y=Yes, N=No, U=Unknown\*\* Values that are outlined indicate that data from only one landfill were available.

**Appendix B. Default LFG Constituent Concentrations**

Reference	Landfill Name	Co-disposal	(Y, N, or U)*	Compound	Raw Concentration (ppm)	Air Infiltration Corrected Conc. (ppm)	Site Ave** (ppm)	Summary Statistics of (ppm)						Site Averages
								2.20	2.32	2.96	2.97	0.27	0.27	
39	Sunshine Canyon		N	Benzene	0.22	0.25	2.32	0.025	0.027	0.027	0.027	0.027	0.027	Bromodichromethane
23	Toy Canyon		U	Bromoform	0.12	0.12	0.12	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	3.131
43	CB13		U	Bromoform	2.48	2.52	2.52	0.025	0.025	0.025	0.025	0.025	0.025	2.038
43	CB14		Y	Bromoform	7.85	7.91	7.91	0.025	0.025	0.025	0.025	0.025	0.025	3.082
43	CB25		U	Bromoform	2.02	2.04	2.04	0.025	0.025	0.025	0.025	0.025	0.025	11.036
43	CB30		U	Bromoform	1.14	1.20	1.20	0.025	0.025	0.025	0.025	0.025	0.025	-1.058
43	CB4		U	Bromoform	0.60	0.65	0.65	0.025	0.025	0.025	0.025	0.025	0.025	0.592
43	CB11		U	Bromoform	0.55	0.57	0.57	0.025	0.025	0.025	0.025	0.025	0.025	0.521
43	CB14		Y	Bromoform	18.8	19.0	19.0	0.025	0.025	0.025	0.025	0.025	0.025	7.913
43	CB16		Y	Bromoform	1.00	1.02	1.02	0.025	0.025	0.025	0.025	0.025	0.025	0.721
43	CB17		Y	Bromoform	0.00	0.01	0.01	0.001	0.001	0.001	0.001	0.001	0.001	0.001
43	CB18		Y	Bromoform	0.83	0.85	0.85	0.025	0.025	0.025	0.025	0.025	0.025	2.918
43	CB19		Y	Bromoform	2.50	2.51	2.51	0.025	0.025	0.025	0.025	0.025	0.025	7.000
43	CB26		Y	Bromoform	1.50	1.51	1.51	0.025	0.025	0.025	0.025	0.025	0.025	<10.
43	CB27		U	Bulane	0.07	0.11	0.11	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	Bulane
43	CB32		U	Bulane	5.00	5.03	5.03	0.025	0.025	0.025	0.025	0.025	0.025	5.025
43	CB33		U	Bulane	1.13	1.13	1.13	0.025	0.025	0.025	0.025	0.025	0.025	12.775
43	CB34		U	Bulane	0.50	0.50	0.50	0.025	0.025	0.025	0.025	0.025	0.025	150.697
43	CB35		U	Bulane	11.8	11.9	11.9	0.025	0.025	0.025	0.025	0.025	0.025	1.044
43	CB36		U	Bulane	0.50	0.57	0.57	0.025	0.025	0.025	0.025	0.025	0.025	1.039
43	CB37		U	Bulane	0.30	0.32	0.32	0.025	0.025	0.025	0.025	0.025	0.025	39.699
43	CB38		U	Bulane	38.0	40.0	40.0	0.025	0.025	0.025	0.025	0.025	0.025	40.000
43	CB39		U	Bulane	11.6	16.8	16.8	0.025	0.025	0.025	0.025	0.025	0.025	40.000
43	CB40		U	Bulane	0.69	0.84	0.84	0.025	0.025	0.025	0.025	0.025	0.025	149.111
43	CB41		U	Bulane	0.93	0.95	0.95	0.025	0.025	0.025	0.025	0.025	0.025	15.000
43	CB42		Y	Bulane	0.41	0.43	0.43	0.025	0.025	0.025	0.025	0.025	0.025	<.05
43	CB43		Y	Bulane	0.66	1.46	1.46	0.025	0.025	0.025	0.025	0.025	0.025	0.025
43	CB44		Y	Bulane	0.40	0.40	0.40	0.025	0.025	0.025	0.025	0.025	0.025	0.025
43	CB45		Y	Bulane	0.50	1.08	1.08	0.025	0.025	0.025	0.025	0.025	0.025	0.025
43	CB46		Y	Bulane	0.50	1.45	1.45	0.025	0.025	0.025	0.025	0.025	0.025	0.025
43	CB47		Y	Bulane	0.50	1.69	1.69	0.025	0.025	0.025	0.025	0.025	0.025	0.025
43	CB48		Y	Bulane	1.60	1.69	1.69	0.025	0.025	0.025	0.025	0.025	0.025	0.025
43	CB49		Y	Bulane	0.30	0.67	0.67	0.025	0.025	0.025	0.025	0.025	0.025	0.025
43	CB50		Y	Bulane	0.20	1.64	1.64	0.025	0.025	0.025	0.025	0.025	0.025	0.025
43	CB51		Y	Bulane	0.070	0.076	0.076	0.025	0.025	0.025	0.025	0.025	0.025	0.076
43	CB52		Y	Bulane	0.90	1.31	1.31	0.025	0.025	0.025	0.025	0.025	0.025	1.644
43	CB53		Y	Bulane	0.81	1.16	1.16	0.025	0.025	0.025	0.025	0.025	0.025	4.654
43	CB54		Y	Bulane	0.85	1.18	1.18	0.025	0.025	0.025	0.025	0.025	0.025	8.000
43	CB55		Y	Bulane	1.00	1.38	1.38	0.025	0.025	0.025	0.025	0.025	0.025	>20.
43	CB56		Y	Bulane	0.00006	0.00006	0.00006	0.025	0.025	0.025	0.025	0.025	0.025	0.025
43	CB57		Y	Bulane	0.050	0.11	0.11	0.025	0.025	0.025	0.025	0.025	0.025	0.025
43	CB58		Y	Bulane	0.00000	0.00006	0.00006	0.025	0.025	0.025	0.025	0.025	0.025	0.025
43	CB59		Y	Bulane	0.00000	0.00006	0.00006	0.025	0.025	0.025	0.025	0.025	0.025	0.025
43	CB60		Y	Bulane	0.00000	0.00006	0.00006	0.025	0.025	0.025	0.025	0.025	0.025	0.025
43	CB61		Y	Bulane	0.00000	0.00006	0.00006	0.025	0.025	0.025	0.025	0.025	0.025	0.025
43	CB62		Y	Bulane	0.00000	0.00006	0.00006	0.025	0.025	0.025	0.025	0.025	0.025	0.025
43	CB63		Y	Bulane	0.00000	0.00006	0.00006	0.025	0.025	0.025	0.025	0.025	0.025	0.025
43	CB64		Y	Bulane	0.00000	0.00006	0.00006	0.025	0.025	0.025	0.025	0.025	0.025	0.025
43	CB65		Y	Bulane	0.00000	0.00006	0.00006	0.025	0.025	0.025	0.025	0.025	0.025	0.025
43	CB66		Y	Bulane	0.00000	0.00006	0.00006	0.025	0.025	0.025	0.025	0.025	0.025	0.025
43	CB67		Y	Bulane	0.00000	0.00006	0.00006	0.025	0.025	0.025	0.025	0.025	0.025	0.025
43	CB68		Y	Bulane	0.00000	0.00006	0.00006	0.025	0.025	0.025	0.025	0.025	0.025	0.025
43	CB69		Y	Bulane	0.00000	0.00006	0.00006	0.025	0.025	0.025	0.025	0.025	0.025	0.025
43	CB70		Y	Bulane	0.00000	0.00006	0.00006	0.025	0.025	0.025	0.025	0.025	0.025	0.025
43	CB71		Y	Bulane	0.00000	0.00006	0.00006	0.025	0.025	0.025	0.025	0.025	0.025	0.025
43	CB72		Y	Bulane	0.00000	0.00006	0.00006	0.025	0.025	0.025	0.025	0.025	0.025	0.025
43	CB73		Y	Bulane	0.00000	0.00006	0.00006	0.025	0.025	0.025	0.025	0.025	0.025	0.025
43	CB74		Y	Bulane	0.00000	0.00006	0.00006	0.025	0.025	0.025	0.025	0.025	0.025	0.025
43	CB75		Y	Bulane	0.00000	0.00006	0.00006	0.025	0.025	0.025	0.025	0.025	0.025	0.025
43	CB76		Y	Bulane	0.00000	0.00006	0.00006	0.025	0.025	0.025	0.025	0.025	0.025	0.025
43	CB77		Y	Bulane	0.00000	0.00006	0.00006	0.025	0.025	0.025	0.025	0.025	0.025	0.025
43	CB78		Y	Bulane	0.00000	0.00006	0.00006	0.025	0.025	0.025	0.025	0.025	0.025	0.025
43	CB79		Y	Bulane	0.00000	0.00006	0.00006	0.025	0.025	0.025	0.025	0.025	0.025	0.025
43	CB80		Y	Bulane	0.00000	0.00006	0.00006	0.025	0.025	0.025	0.025	0.025	0.025	0.025
43	CB81		Y	Bulane	0.00000	0.00006	0.00006	0.025	0.025	0.025	0.025	0.025	0.025	0.025
43	CB82		Y	Bulane	0.00000	0.00006	0.00006	0.025	0.025	0.025	0.025	0.025	0.025	0.025
43	CB83		Y	Bulane	0.00000	0.00006	0.00006	0.025	0.025	0.025	0.025	0.025	0.025	0.025
43	CB84		Y	Bulane	0.00000	0.00006	0.00006	0.025	0.025	0.025	0.025	0.025	0.025	0.025
43	CB85		Y	Bulane	0.00000	0.00006	0.00006	0.025	0.025	0.025	0.025	0.025	0.025	0.025
43	CB86		Y	Bulane	0.00000	0.00006	0.00006	0.025	0.025	0.025	0.025	0.025	0.025	0.025
43	CB87		Y	Bulane	0.00000	0.00006	0.00006	0.025	0.025	0.025	0.025	0.025	0.025	0.025
43	CB88		Y	Bulane	0.00000	0.00006	0.00006	0.025	0.025	0.025	0.025	0.025	0.025	0.025
43	CB89		Y	Bulane	0.00000	0.00006	0.00006	0.025	0.025	0.025	0.025	0.025	0.025	0.025
43	CB90		Y	Bulane	0.00000	0.00006	0.00006	0.025	0.025	0.025	0.025	0.025	0.025	0.025
43	CB91		Y	Bulane	0.00000	0.00006	0.00006	0.025	0.025	0.025	0.025	0.025	0.025	0.025
43	CB92		Y	Bulane	0.00000	0.00006	0.00006	0.025	0.025	0.025	0.025	0.025	0.025	0.025
43	CB93		Y	Bulane	0.00000	0.00								

**Appendix B. Default LFG Constituent Concentrations**

Reference	Landfill Name	Co-disposal	(Y, N, or U)*	Compound	Raw Concentration (ppm)			Summary Statistics of (ppm)		
					Air Infiltration Corrected Conc. (ppm)	Site Avg.** (ppm)	Site Averages	Mean	Median	Standard Deviation
55	Coyote Canyon	u	u	Carbon tetrachloride	0.0005	0.0007	0.0007	0.0007	0.0007	0.0007
56	Coyote Canyon	u	u	Carbon tetrachloride	0.0025	0.0033	0.0033	0.0033	0.0033	0.0033
56	Coyote Canyon	u	u	Carbon tetrachloride	0.0025	0.0036	0.0036	0.0036	0.0036	0.0036
56	Coyote Canyon	u	u	Carbon tetrachloride	0.0025	0.0037	0.0037	0.0037	0.0037	0.0037
57	Durham Rd.	u	u	Carbon tetrachloride	0.0025	0.0030	0.0030	0.0030	0.0030	0.0030
57	Durham Rd.	u	u	Carbon tetrachloride	0.0025	0.0030	0.0030	0.0030	0.0030	0.0030
27	Lyon Development	u	u	Carbon tetrachloride	0.040	0.047	0.045	0.045	0.045	0.045
27	Lyon Development	u	u	Carbon tetrachloride	0.040	0.048	0.048	0.048	0.048	0.048
58	Oby Annex	u	u	Carbon tetrachloride	0.0025	0.0027	0.0027	0.0027	0.0027	0.0027
20	Parrose	u	u	Carbon tetrachloride	0.0025	0.0032	0.0032	0.0032	0.0032	0.0032
20	Parrose	u	u	Carbon tetrachloride	0.0025	0.0043	0.0043	0.0043	0.0043	0.0043
20	Parrose	u	u	Carbon tetrachloride	0.0025	0.0051	0.0051	0.0051	0.0051	0.0051
20	Parrose	u	u	Carbon tetrachloride	0.0025	0.0059	0.0059	0.0059	0.0059	0.0059
59	Rockingham	u	u	Carbon tetrachloride	0.0040	0.0078	0.0078	0.0078	0.0078	0.0078
9	Shelton Street	u	u	Carbon tetrachloride	0.15	0.20	0.20	0.20	0.20	0.21
8	Shelton Street	u	u	Carbon tetrachloride	0.0015	0.0165	0.0165	0.0165	0.0165	0.0165
9	Shelton Street	u	u	Carbon tetrachloride	0.0015	0.0190	0.0190	0.0190	0.0190	0.0190
12	BKK Landfill	y	y	Carbon tetrachloride	0.11	0.24	0.23	0.23	0.23	0.23
12	BKK Landfill	y	y	Carbon tetrachloride	0.094	0.22	0.22	0.22	0.22	0.22
7	Calabasas	u	u	Carbon tetrachloride	0.10	0.20	0.20	0.20	0.20	0.21
7	Calabasas	u	u	Carbon tetrachloride	0.020	0.031	0.031	0.031	0.031	0.031
84	Oby Landfill	u	u	Carbon tetrachloride	0.020	0.027	0.027	0.027	0.027	0.027
22	Pais Verdes	u	u	Carbon tetrachloride	0.0020	0.0022	0.0022	0.0022	0.0022	0.0022
22	Pais Verdes	u	u	Carbon tetrachloride	0.0024	0.0033	0.0033	0.0033	0.0033	0.0033
22	Pais Verdes	u	u	Carbon tetrachloride	0.0026	0.0035	0.0035	0.0035	0.0035	0.0035
22	Pais Verdes	u	u	Carbon tetrachloride	0.0028	0.0046	0.0046	0.0046	0.0046	0.0046
22	Pais Verdes	u	u	Carbon tetrachloride	0.0034	0.0055	0.0055	0.0055	0.0055	0.0055
22	Pais Verdes	u	u	Carbon tetrachloride	0.0015	0.0065	0.0065	0.0065	0.0065	0.0065
22	Pais Verdes	u	u	Carbon tetrachloride	0.0015	0.0077	0.0077	0.0077	0.0077	0.0077
22	Pais Verdes	u	u	Carbon tetrachloride	0.0012	0.0052	0.0052	0.0052	0.0052	0.0052
22	Pais Verdes	u	u	Carbon tetrachloride	0.0012	0.0052	0.0052	0.0052	0.0052	0.0052
22	Pais Verdes	u	u	Carbon tetrachloride	0.0034	0.0115	0.0115	0.0115	0.0115	0.0115
22	Pais Verdes	u	u	Carbon tetrachloride	0.0026	0.0055	0.0055	0.0055	0.0055	0.0055
51	Pais Verdes	u	u	Carbon tetrachloride	0.010	0.026	0.026	0.026	0.026	0.026
51	Pais Verdes	u	u	Carbon tetrachloride	0.010	0.032	0.032	0.032	0.032	0.032
54	Armenia Hill	u	u	Chalcopyrite	0.044	0.055	0.057	0.057	0.057	0.057
15	Arnold Landfill Recreational	u	u	Chalcopyrite	0.058	0.069	0.069	0.069	0.069	0.069
12	BKK Landfill	y	y	Chalcopyrite	2.30	24.0	24.0	24.0	24.0	24.0
12	BKK Landfill	y	y	Chalcopyrite	1.40	3.14	3.14	3.14	3.14	3.14
12	BKK Landfill	y	y	Chalcopyrite	1.40	3.09	3.09	3.09	3.09	3.09
12	BKK Landfill	y	y	Chalcopyrite	0.80	1.72	1.72	1.72	1.72	1.72
12	BKK Landfill	y	y	Chalcopyrite	0.90	1.91	1.91	1.91	1.91	1.91
12	BKK Landfill	y	y	Chalcopyrite	0.25	0.54	0.54	0.54	0.54	0.54
12	BKK Landfill	y	y	Chalcopyrite	0.25	0.56	0.56	0.56	0.56	0.56
7	Calabasas	u	u	Chalcopyrite	0.05	0.08	0.08	0.08	0.08	0.08
24	Puente Hills	n	n	Chalcopyrite	0.57	0.83	0.83	0.83	0.83	0.83
24	Puente Hills	n	n	Chalcopyrite	0.81	1.16	1.16	1.16	1.16	1.16
24	Puente Hills	n	n	Chalcopyrite	0.84	1.18	1.18	1.18	1.18	1.18
24	Puente Hills	n	n	Chalcopyrite	0.89	1.68	1.68	1.68	1.68	1.68
50	Sobel Canyon	n	n	Chalcopyrite	0.050	0.0006	0.0006	0.0006	0.0006	0.0006
54	Arbor Hills	u	u	Chlorobenzene	0.71	0.11	0.11	0.11	0.11	0.11
54	Arbor Hills	u	u	Chlorobenzene	0.74	0.60	0.60	0.60	0.60	0.60
43	CB112	u	u	Chlorobenzene	0.70	0.72	0.72	0.72	0.72	0.72
43	CB113	u	u	Chlorobenzene	0.20	0.22	0.22	0.22	0.22	0.22
43	CB115	u	u	Chlorobenzene	0.16	0.18	0.18	0.18	0.18	0.18
43	CB122	u	u	Chlorobenzene	0.05	0.05	0.05	0.05	0.05	0.05
43	CB124	u	u	Chlorobenzene	0.10	0.10	0.10	0.10	0.10	0.10
43	CB29	u	u	Chlorobenzene	0.12	0.12	0.12	0.12	0.12	0.12
43	CB30	u	u	Chlorobenzene	0.20	0.20	0.20	0.20	0.20	0.20
43	CB31	u	u	Chlorobenzene	0.43	0.43	0.43	0.43	0.43	0.43
43	Chirocane	u	u	Chlorobenzene	7.15	7.22	7.22	7.22	7.22	7.22
56	Coyote Canyon	u	u	Chlorobenzene	0.10	0.13	0.13	0.13	0.13	0.13
56	Coyote Canyon	u	u	Chlorobenzene	0.010	0.013	0.013	0.013	0.013	0.013
56	Coyote Canyon	u	u	Chlorobenzene	0.010	0.015	0.015	0.015	0.015	0.015
56	Coyote Canyon	u	u	Chlorobenzene	0.50	0.74	0.74	0.74	0.74	0.74

\* Y=Yes, N=No, U=Unknown\*\* Values that are outlined indicate that data from only one landfill were available.

## Appendix B. Default LFG Constituent Concentrations

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## **Appendix B. Default LFG Constituent Concentrations**

\* Y=Yes, N=No, U=Unknown\*\* Values that are outlined indicate that data from only one landfill were available.

**Appendix B. Default LFG Constituent Concentrations**

Reference	Landfill Name	Co-disposal	(Y, N, or U)*	Compound	Raw Concentration (ppm)	Air Infiltration Corrected Conc. (ppm)	Site Avg.** (ppm)	Summary Statistics of (ppm)						
								Count	Normality Test (p)	Mean	Median	Standard Deviation	Variance	Kurtosis
12	BKK Landfill			Dimethyl sulfide	6.60	14.60	9.59	3.36	< .01*	124.622				
12	BKK Landfill			Dimethyl sulfide	6.70	14.92	9.59	3.36		598.811				
12	BKK Landfill			Dimethyl sulfide	6.70	14.92	9.59	3.36		38574.156				
6	Bradley Pt.			Dimethyl sulfide	2.20	0.05	0.07	0.15	< .05†	1.057				
7	Calabasas			Dimethyl sulfide	9.35	0.17	0.23	12.9		0.355				
56	Coyote Canyon			Dimethyl sulfide	7.70	8.70	12.9	1.7		173.19				
56	Coyote Canyon			Dimethyl sulfide	7.80	8.50	12.5	0.5		21.90				
56	Coyote Canyon			Dimethyl sulfide	8.50	8.50	12.4	0.12		180.119				
24	Puente Hills			Dimethyl sulfide	1.00	0.00	10.8	10.8		8002.349				
24	Puente Hills			Dimethyl sulfide	7.00	10.9	10.9	2.97		9.000				
24	Puente Hills			Dimethyl sulfide	7.00	10.9	10.9	0.0039		9.000				
50	Sabot Canyon			Dimethyl sulfide	1.00	1.00	1.00	1.00	< .05‡	1.000				
39	Sunshine Canyon			Ethane	6.20	9.30	11.25	6.53		900.381				
43	CBH13			Ethane	1.780	2.69	1802	1.802		N/A				
43	CBH14			Ethane	1.420	1.420	1431	1.421		42.33				
43	CB24			Ethane	0.500	0.500	0.508	0.508		5.988				
43	CB25			Ethane	0.500	0.500	0.500	0.500		27.005				
43	CB26			Ethane	0.500	0.500	0.500	0.500		27.005				
43	CB28			Ethane	0.500	0.500	0.500	0.500		27.005				
43	CB29			Ethane	0.500	0.500	0.500	0.500		27.005				
43	CB30			Ethane	0.500	0.500	0.500	0.500		27.005				
43	CB31			Ethane	0.500	0.500	0.500	0.500		27.005				
102	Fresh Kills Landfill			Ethane	16.9	22.3	21.9	21.9		5.988				
103	Puente Hills			Ethane	0.00	0.00	240.4	240.4		48.4				
41	Guadalupe			Ethanol	4.60	5.99	5.99	5.99		5.988				
60	Sunshine Canyon			Ethanol	4.60	48.1	48.1	48.1		48.421				
54	Arbor Hills			Ethyl benzene	18.7	18.7	19.4	19.4		54.09				
54	Arbor Hills			Ethyl benzene	19.6	19.6	19.1	19.1		2.000				
54	Arbor Hills			Ethyl benzene	19.6	19.6	19.8	19.8		54.09				
54	Arbor Hills			Ethyl benzene	19.6	19.6	19.4	19.4		54.09				
43	CBH1			Ethyl benzene	6.50	6.50	6.22	6.22		5.988				
43	CBH10			Ethyl benzene	5.70	5.70	5.81	5.81		5.988				
43	CBH11			Ethyl benzene	4.00	4.00	5.06	5.06		5.988				
43	CBH12			Ethyl benzene	4.06	4.06	4.47	4.47		5.988				
43	CBH13			Ethyl benzene	37.0	42.0	44.7	44.7		5.988				
43	CBH14			Ethyl benzene	4.20	4.25	4.25	4.25		5.988				
43	CBH15			Ethyl benzene	0.23	0.23	0.23	0.23		5.988				
43	CBH16			Ethyl benzene	1.30	1.30	1.32	1.32		5.988				
43	CBH17			Ethyl benzene	0.16	0.16	0.15	0.15		5.988				
43	CBH18			Ethyl benzene	7.00	7.00	7.14	7.14		5.988				
43	CBH19			Ethyl benzene	0.20	0.20	0.20	0.20		5.988				
43	CB20			Ethyl benzene	1.55	1.55	1.55	1.55		5.988				
43	CB21			Ethyl benzene	1.00	1.00	1.00	1.00		5.988				
43	CB22			Ethyl benzene	0.25	0.25	0.25	0.25		5.988				
43	CB23			Ethyl benzene	0.00	0.00	4.25	4.25		5.988				
43	CB24			Ethyl benzene	35.4	35.4	35.9	35.9		5.988				
43	CB25			Ethyl benzene	48.1	48.1	48.5	48.5		5.988				
43	CB26			Ethyl benzene	0.70	0.70	0.70	0.70		5.988				
43	CB27			Ethyl benzene	3.73	3.73	3.76	3.76		5.988				
43	CB28			Ethyl benzene	0.80	0.80	0.80	0.80		5.988				
43	CB29			Ethyl benzene	40.9	40.9	44.1	44.1		5.988				
43	CB30			Ethyl benzene	4.40	4.40	4.41	4.41		5.988				
43	CB31			Ethyl benzene	23.4	23.4	23.6	23.6		5.988				
43	CB32			Ethyl benzene	4.50	4.50	4.61	4.61		5.988				
43	CB33			Ethyl benzene	0.65	0.65	0.65	0.65		5.988				
43	CB34			Ethyl benzene	2.73	2.73	2.74	2.74		5.988				
43	CB35			Ethyl benzene	16.2	16.2	17.0	17.0		5.988				
43	CB36			Ethyl benzene	6.75	6.75	6.82	6.82		5.988				
43	CB37			Ethyl benzene	0.30	0.30	0.30	0.30		5.988				
43	CB38			Ethyl benzene	22.0	22.0	22.5	22.5		5.988				
43	CB39			Ethyl benzene	7.22	7.22	7.28	7.28		5.988				
43	CB40			Ethyl benzene	3.80	3.80	3.84	3.84		5.988				
41	Guadalupe			Ethyl benzene	3.10	3.10	3.71	3.71		5.988				
27	Lyon Development			Ethyl benzene	5.50	5.50	6.47	6.47		5.988				
27	Lyon Development			Ethyl benzene	2.90	2.90	3.45	3.45		5.988				
59	Rockett Ranch			Ethyl benzene	3.50	3.50	3.90	3.90		5.988				
60	Santa Fe Canyon			Ethyl benzene	0.00	0.00	0.68	0.68		5.988				
54	ASCE FH			Ethyl mercaptan	0.20	0.20	0.21	0.21		5.988				
54	Arbor Hills			Ethyl mercaptan	0.13	0.13	0.13	0.13		5.988				
12	BKK Landfill			Ethyl mercaptan	-1.90	-1.90	4.26	4.26		5.988				
12	BKK Landfill			Ethyl mercaptan	4.19	4.19	4.19	4.19		5.988				
12	BKK Landfill			Ethyl mercaptan	2.20	2.20	4.75	4.75		5.988				
12	BKK Landfill			Ethyl mercaptan	-1.70	-1.70	3.66	3.66		5.988				
12	BKK Landfill			Ethyl mercaptan	2.30	2.30	4.88	4.88		5.988				
12	BKK Landfill			Ethyl mercaptan	2.90	2.90	8.38	8.38		5.988				

\* Y=Yes, N=No, U=Unknown\*\* Values that are outlined indicate that data from only one landfill were available.

## Appendix B. Default LFG Constituent Concentrations

Reference	Landfill Name	Compound	Raw Concentration (ppm)			Site Avg.* (ppmv)	Summary Statistics of (ppmv)			Site Averages
			Co-disposal	(Y, N, or U)	Ethy mercaptan		Minimum	Maximum	Sum	
12	BKK Landfill	Ethy mercaptan	Y	Y	6.15	0.24	0.00060	0.00060	0.00060	0.24
12	BKK Landfill	Ethy mercaptan	Y	Y	5.17	5.365	0.00058	0.00058	0.00058	5.365
12	BKK Landfill	Ethy mercaptan	Y	Y	2.70	6.849	0.00050	0.00050	0.00050	6.849
56	Coyote Canyon	Ethy mercaptan	U	U	0.61	3.000	0.00050	0.00050	0.00050	3.000
56	Coyote Canyon	Ethy mercaptan	U	U	0.40	1.40	0.00050	0.00050	0.00050	1.40
53	Allamont	Ethyene dibromide	U	U	1.90	0.80	0.00050	0.00050	0.00050	0.80
53	Allamont	Ethyene dibromide	U	U	1.25	0.00050	0.00050	0.00050	0.00050	0.00050
57	Durham Rd.	Ethyene dibromide	U	U	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050
57	Durham Rd.	Ethyene dibromide	U	U	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050
44	Gualdalupe	Ethyene dibromide and Ethylene dibromic acid	U	U	3.1	40.8	0.00050	0.00050	0.00050	40.8
44	Gualdalupe	Ethyene dibromide and Ethylene dibromic acid	U	U	25.6	30.7	0.00050	0.00050	0.00050	30.7
44	Gualdalupe	Ethyene dibromide and Ethylene dibromic acid	U	U	4.70	5.53	0.00050	0.00050	0.00050	5.53
43	Guadalupe	Ethyene dibromide and Ethylene dibromic acid	U	U	0.61	0.81	0.00050	0.00050	0.00050	0.81
43	CB10	Fluorochloromethane	Y	Y	2.85	2.88	0.00050	0.00050	0.00050	2.88
43	CB11	Fluorochloromethane	Y	Y	0.48	0.53	0.00050	0.00050	0.00050	0.53
43	CB13	Fluorochloromethane	Y	Y	0.66	0.80	0.00050	0.00050	0.00050	0.80
43	CB14	Fluorochloromethane	Y	Y	1.35	1.37	0.00050	0.00050	0.00050	1.37
43	CB15	Fluorochloromethane	Y	Y	0.73	0.74	0.00050	0.00050	0.00050	0.74
43	CB16	Fluorochloromethane	Y	Y	0.70	0.71	0.00050	0.00050	0.00050	0.71
43	CB17	Fluorochloromethane	Y	Y	2.35	2.37	0.00050	0.00050	0.00050	2.37
43	CB18	Fluorochloromethane	Y	Y	1.33	1.33	0.00050	0.00050	0.00050	1.33
43	CB19	Fluorochloromethane	Y	Y	1.05	1.05	0.00050	0.00050	0.00050	1.05
43	CB20	Fluorochloromethane	Y	Y	3.75	3.75	0.00050	0.00050	0.00050	3.75
43	CB21	Fluorochloromethane	Y	Y	1.09	1.09	0.00050	0.00050	0.00050	1.09
43	CB22	Fluorochloromethane	Y	Y	0.67	0.68	0.00050	0.00050	0.00050	0.68
43	CB23	Fluorochloromethane	Y	Y	2.10	2.23	0.00050	0.00050	0.00050	2.23
43	CB24	Fluorochloromethane	Y	Y	0.06	0.06	0.00050	0.00050	0.00050	0.06
43	CB25	Fluorochloromethane	Y	Y	0.77	0.78	0.00050	0.00050	0.00050	0.78
43	CB26	Fluorochloromethane	Y	Y	0.45	0.45	0.00050	0.00050	0.00050	0.45
43	CB27	Fluorochloromethane	Y	Y	0.50	0.50	0.00050	0.00050	0.00050	0.50
43	CB30	Fluorochloromethane	Y	Y	0.47	0.47	0.00050	0.00050	0.00050	0.47
43	CB32	Fluorochloromethane	Y	Y	7.94	7.94	0.00050	0.00050	0.00050	7.94
43	CB33	Fluorochloromethane	Y	Y	7.90	7.94	0.00050	0.00050	0.00050	7.94
43	CB34	Fluorochloromethane	Y	Y	0.00	0.00	0.00050	0.00050	0.00050	0.00
43	CB35	Fluorochloromethane	Y	Y	0.00	0.00	0.00050	0.00050	0.00050	0.00
43	CB36	Fluorochloromethane	Y	Y	0.25	0.25	0.00050	0.00050	0.00050	0.25
43	CB37	Fluorochloromethane	Y	Y	11.3	12.0	0.00050	0.00050	0.00050	12.0
43	CB38	Fluorochloromethane	Y	Y	0.20	0.20	0.00050	0.00050	0.00050	0.20
43	CB39	Fluorochloromethane	Y	Y	0.64	0.64	0.00050	0.00050	0.00050	0.64
43	CB40	Fluorochloromethane	Y	Y	1.03	1.11	0.00050	0.00050	0.00050	1.11
43	CB41	Heane	Y	Y	6.57	6.57	0.00050	0.00050	0.00050	6.57
43	CB13	Heane	Y	Y	2.49	3.01	0.00050	0.00050	0.00050	3.01
43	CB14	Heane	Y	Y	21.1	21.1	0.00050	0.00050	0.00050	21.1
43	CB16	Heane	Y	Y	2.49	2.44	0.00050	0.00050	0.00050	2.44
43	CB17	Heane	Y	Y	3.03	3.03	0.00050	0.00050	0.00050	3.03
43	CB18	Heane	Y	Y	4.77	4.77	0.00050	0.00050	0.00050	4.77
43	CB19	Heane	Y	Y	1.51	1.51	0.00050	0.00050	0.00050	1.51
43	CB24	Heane	Y	Y	6.34	6.44	0.00050	0.00050	0.00050	6.44
43	CB25	Heane	Y	Y	13.5	13.5	0.00050	0.00050	0.00050	13.5
43	CB26	Heane	Y	Y	7.13	7.18	0.00050	0.00050	0.00050	7.18
43	CB27	Heane	Y	Y	6.06	6.12	0.00050	0.00050	0.00050	6.12
43	CB30	Heane	Y	Y	1.00	1.00	0.00050	0.00050	0.00050	1.00
43	CB32	Heane	Y	Y	10.1	10.1	0.00050	0.00050	0.00050	10.1
43	CB33	Heane	Y	Y	3.84	3.84	0.00050	0.00050	0.00050	3.84
43	CB44	Heane	Y	Y	7.67	7.67	0.00050	0.00050	0.00050	7.67
43	CB55	Heane	Y	Y	11.4	11.4	0.00050	0.00050	0.00050	11.4
43	CB60	Heane	Y	Y	7.05	7.05	0.00050	0.00050	0.00050	7.05
43	CB61	Heane	Y	Y	16.1	16.1	0.00050	0.00050	0.00050	16.1
43	CB62	Heane	Y	Y	2.33	2.33	0.00050	0.00050	0.00050	2.33
54	Arbor Hills	Hydrogen sulfide	Y	Y	21.1	20.8	0.00050	0.00050	0.00050	20.8
54	Arbor Hills	Hydrogen sulfide	Y	Y	28.0	29.2	0.00050	0.00050	0.00050	29.2
15	Azusa Land Reclamation	Hydrogen sulfide	Y	Y	34.0	35.5	0.00050	0.00050	0.00050	35.5
15	Azusa Land Reclamation	Hydrogen sulfide	Y	Y	36.0	37.5	0.00050	0.00050	0.00050	37.5
15	Azusa Land Reclamation	Hydrogen sulfide	Y	Y	39.0	40.7	0.00050	0.00050	0.00050	40.7
15	Azusa Land Reclamation	Hydrogen sulfide	Y	Y	37.5	37.5	0.00050	0.00050	0.00050	37.5
12	BKK Landfill	Hydrogen sulfide	Y	Y	11.7	11.7	0.00050	0.00050	0.00050	11.7
12	BKK Landfill	Hydrogen sulfide	Y	Y	5.30	5.30	0.00050	0.00050	0.00050	5.30
12	BKK Landfill	Hydrogen sulfide	Y	Y	6.12	6.12	0.00050	0.00050	0.00050	6.12
12	BKK Landfill	Hydrogen sulfide	Y	Y	17.7	17.7	0.00050	0.00050	0.00050	17.7
12	BKK Landfill	Hydrogen sulfide	Y	Y	1.69	1.69	0.00050	0.00050	0.00050	1.69
12	BKK Landfill	Hydrogen sulfide	Y	Y	4.88	4.88	0.00050	0.00050	0.00050	4.88
12	BKK Landfill	Hydrogen sulfide	Y	Y	5.80	5.80	0.00050	0.00050	0.00050	5.80
12	BKK Landfill	Hydrogen sulfide	Y	Y	16.6	16.6	0.00050	0.00050	0.00050	16.6
12	BKK Landfill	Hydrogen sulfide	Y	Y	8.40	8.40	0.00050	0.00050	0.00050	8.40
12	BKK Landfill	Hydrogen sulfide	Y	Y	22.3	22.3	0.00050	0.00050	0.00050	22.3
6	Bradley Pit	Hydrogen sulfide	Y	Y	64.0	64.0	0.00050	0.00050	0.00050	64.0
6	Bradley Pit	Hydrogen sulfide	Y	Y	77.7	77.7	0.00050	0.00050	0.00050	77.7
7	Calabasas	Hydrogen sulfide	Y	Y	74.0	74.0	0.00050	0.00050	0.00050	74.0
7	Calabasas	Hydrogen sulfide	Y	Y	11.3	11.3	0.00050	0.00050	0.00050	11.3
56	Coyote Canyon	Hydrogen sulfide	Y	Y	46.4	46.4	0.00050	0.00050	0.00050	46.4
56	Coyote Canyon	Hydrogen sulfide	Y	Y	68.4	68.4	0.00050	0.00050	0.00050	68.4

\* Y=Yes N=No ||=Unknown\*\* Values that are outlined indicate that data from only one landfill were available

**Appendix B. Default LFG Constituent Concentrations**

Reference	Plots/Variables	Landfill Name	Co-disposal	(Y, N, or U)*	Compound	Raw Concentration (ppm)	Air Infiltration Corrected Conc. (ppm)	Site Ave** (ppm)	Summary Statistics of (ppm)				Site Averages
									Mean	Median	Standard Deviation	Variance	
51	Pilot Variables	Puerto Hills		N	Hydrogen sulfide	20.0	51.2	51.2	0.012	0.012	0.112	51.2	
50		Sunshine Canyon		N	Hydrogen sulfide	0.10	0.012	0.012	0.012	0.012	0.012	0.012	
1		BKK Landfill		U	Hydrogen sulfide	5.10	11.7	11.7	82.1	82.1	82.1	82.1	
60				Y	Hydrogen sulfide	78.0	4.04	4.04	4.04	4.04	4.04	4.04	
12		BKK Landfill		Y	Hydrogen sulfide	1.60	3.53	3.53	3.67	3.67	3.67	3.67	
12		BKK Landfill		Y	Hydrogen sulfide	1.70	3.66	3.66	3.66	3.66	3.66	3.66	
12		BKK Landfill		Y	Hydrogen sulfide	1.70	4.03	4.03	4.03	4.03	4.03	4.03	
12		BKK Landfill		Y	Hydrogen sulfide	1.70	5.23	5.23	5.23	5.23	5.23	5.23	
12		BKK Landfill		Y	Hydrogen sulfide	1.70	5.14	5.14	5.14	5.14	5.14	5.14	
12		BKK Landfill		Y	Hydrogen sulfide	2.30	8.62	8.62	8.62	8.62	8.62	8.62	
12		BKK Landfill		Y	Hydrogen sulfide	2.30	8.62	8.62	8.62	8.62	8.62	8.62	
41		Guadalupe Lope		U	Isobutanol	7.20	0.00149	0.00149	0.00149	0.00149	0.00149	0.00149	
103		Fresnillo Hills		U	Mercury (total)	0.00149	0.000134	0.000134	0.000134	0.000134	0.000134	0.000134	
94		Landfill A		U	Mercury (total)	0.00134	0.000134	0.000134	0.000134	0.000134	0.000134	0.000134	
94		Landfill B		U	Mercury (total)	0.00134	0.000134	0.000134	0.000134	0.000134	0.000134	0.000134	
94		Landfill C		U	Mercury (total)	0.00134	0.000134	0.000134	0.000134	0.000134	0.000134	0.000134	
94		Landfill D		U	Mercury (total)	0.00134	0.000134	0.000134	0.000134	0.000134	0.000134	0.000134	
94		Landfill E		U	Mercury (total)	0.00134	0.000134	0.000134	0.000134	0.000134	0.000134	0.000134	
94		Landfill F		U	Mercury (total)	0.00134	0.000134	0.000134	0.000134	0.000134	0.000134	0.000134	
94		Landfill G		U	Mercury (total)	0.00134	0.000134	0.000134	0.000134	0.000134	0.000134	0.000134	
94		Landfill H		U	Mercury (total)	0.00134	0.000134	0.000134	0.000134	0.000134	0.000134	0.000134	
95		Landfill A		U	Mercury (total)	0.00134	0.000134	0.000134	0.000134	0.000134	0.000134	0.000134	
95		Landfill B		U	Mercury (total)	0.00134	0.000134	0.000134	0.000134	0.000134	0.000134	0.000134	
95		Landfill C		U	Mercury (total)	0.00134	0.000134	0.000134	0.000134	0.000134	0.000134	0.000134	
97		MoutainGate Landfill		U	Mercury (total)	0.00013	0.00013	0.00013	0.00013	0.00013	0.00013	0.00013	
41		Guadalupe		U	Methyl cyclohexane	26.0	31.1	31.1	31.1	31.1	31.1	31.1	
43		CBH11		U	Methyl ethyl ketone	5.00	5.10	5.10	5.10	5.10	5.10	5.10	
43		CBH12		U	Methyl ethyl ketone	4.95	12.0	12.0	13.2	13.2	13.2	13.2	
43		CBH14		U	Methyl ethyl ketone	4.48	3.79	3.79	3.79	3.79	3.79	3.79	
43		CBH15		U	Methyl ethyl ketone	4.45	7.67	7.67	7.67	7.67	7.67	7.67	
43		CBH16		U	Methyl ethyl ketone	4.45	11.0	11.0	11.1	11.1	11.1	11.1	
43		CBH20		U	Methyl ethyl ketone	4.35	31.3	31.3	31.6	31.6	31.6	31.6	
43		CB22		U	Methyl ethyl ketone	2.50	5.84	5.84	5.84	5.84	5.84	5.84	
43		CB23		U	Methyl ethyl ketone	18.8	19.0	19.0	19.0	19.0	19.0	19.0	
43		CB24		U	Methyl ethyl ketone	6.00	6.03	6.03	6.03	6.03	6.03	6.03	
43		CB26		U	Methyl ethyl ketone	5.00	5.04	5.04	5.04	5.04	5.04	5.04	
43		CB27		U	Methyl ethyl ketone	1.60	1.60	1.60	1.60	1.60	1.60	1.60	
43		CB3		U	Methyl ethyl ketone	2.10	2.10	2.10	2.10	2.10	2.10	2.10	
43		CB31		U	Methyl ethyl ketone	3.65	3.67	3.67	3.67	3.67	3.67	3.67	
43		CB32		U	Methyl ethyl ketone	3.33	6.34	6.34	6.34	6.34	6.34	6.34	
43		CB33		U	Methyl ethyl ketone	2.50	4.02	4.02	4.02	4.02	4.02	4.02	
43		CB5		U	Methyl ethyl ketone	3.33	3.38	3.38	3.38	3.38	3.38	3.38	
43		CB6		U	Methyl ethyl ketone	1.50	1.52	1.52	1.52	1.52	1.52	1.52	
43		CB7		U	Methyl ethyl ketone	13.6	16.3	16.3	16.3	16.3	16.3	16.3	
43		CB8		U	Methyl ethyl ketone	10.8	14.4	14.4	14.4	14.4	14.4	14.4	
43		CB9		U	Methyl ethyl ketone	1.15	1.16	1.16	1.16	1.16	1.16	1.16	
43		CB11		U	Methyl ethyl ketone	0.50	0.55	0.55	0.55	0.55	0.55	0.55	
43		CB12		U	Methyl ethyl ketone	0.45	0.45	0.45	0.45	0.45	0.45	0.45	
43		CB15		U	Methyl ethyl ketone	2.50	2.55	2.55	2.55	2.55	2.55	2.55	
43		CB18		U	Methyl ethyl ketone	4.00	4.02	4.02	4.02	4.02	4.02	4.02	
43		CB20		U	Methyl ethyl ketone	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
43		CB22		U	Methyl ethyl ketone	1.00	1.06	1.06	1.06	1.06	1.06	1.06	
43		CB23		U	Methyl ethyl ketone	5.00	5.08	5.08	5.08	5.08	5.08	5.08	
43		CB27		U	Methyl ethyl ketone	0.50	0.50	0.50	0.50	0.50	0.50	0.50	
43		CB28		U	Methyl ethyl ketone	0.70	0.70	0.70	0.70	0.70	0.70	0.70	
43		CB31		U	Methyl ethyl ketone	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
43		CB33		U	Methyl ethyl ketone	3.33	3.34	3.34	3.34	3.34	3.34	3.34	
43		CB55		U	Methyl isobutyl ketone	6.50	6.57	6.57	6.57	6.57	6.57	6.57	
43		CB7		U	Methyl isobutyl ketone	11.20	11.78	11.78	11.78	11.78	11.78	11.78	
43		CB9		U	Methyl isobutyl ketone	1.20	1.21	1.21	1.21	1.21	1.21	1.21	
54		Arbor Hills		U	Methyl mercaptan	0.29	0.30	0.30	0.30	0.30	0.30	0.30	
54		Arbor Hills		U	Methyl mercaptan	0.73	0.74	0.74	0.74	0.74	0.74	0.74	
54		Arbor Hills		U	Methyl mercaptan	0.51	0.54	0.54	0.54	0.54	0.54	0.54	
15		Azusa Landfill		U	Methyl mercaptan	12.0	12.5	12.5	12.5	12.5	12.5	12.5	
15		Azusa Landfill		U	Methyl mercaptan	1.1	1.1	1.1	1.1	1.1	1.1	1.1	
15		Azusa Landfill		U	Methyl mercaptan	10.0	10.4	10.4	10.4	10.4	10.4	10.4	
15		Azusa Landfill		U	Methyl mercaptan	10.0	10.4	10.4	10.4	10.4	10.4	10.4	
15		Azusa Landfill		U	Methyl mercaptan	11.0	11.5	11.5	11.5	11.5	11.5	11.5	
15		Azusa Landfill		U	Methyl mercaptan	0.88	0.92	0.92	0.92	0.92	0.92	0.92	
12		BKK Landfill		U	Methyl mercaptan	2.50	5.61	5.61	5.61	5.61	5.61	5.61	
12		BKK Landfill		U	Methyl mercaptan	2.10	4.64	4.64	4.64	4.64	4.64	4.64	
12		BKK Landfill		U	Methyl mercaptan	2.40	5.18	5.18	5.18	5.18	5.18	5.18	
12		BKK Landfill		U	Methyl mercaptan	1.60	3.40	3.40	3.40	3.40	3.40	3.40	

\* Y=Yes, N=No, U=Unknown\*\* Values that are outlined indicate that data from only one landfill were available.

**Appendix B. Default LFG Constituent Concentrations**

Reference	Landfill Name	Co-disposal	(Y, N, or U)*	Compound	Raw Concentration (ppm)	Air Infiltration Corrected Conc. (ppm)	Site Avg.** (ppm)	Summary Statistics of (ppm)	Site Averages
12	BKK Landfill		>	Methyl mercaptan	2.0	6.07			
12	BKK Landfill		>	Methyl mercaptan	2.00	4.36			
12	BKK Landfill		>	Methyl mercaptan	2.10	4.71			
6	Burley PH	Cycle Canyon	U	Methyl mercaptan	2.20	4.68			
56	Puente Hills		U	Methyl mercaptan	1.80	3.01			
24	Puente Hills		U	Methyl mercaptan	1.10	2.40			
24	Puente Hills		U	Methyl mercaptan	1.10	1.60			
24	Puente Hills		U	Methyl mercaptan	0.90	1.29			
24	Puente Hills		U	Methyl mercaptan	1.30	1.81			
24	Puente Hills		U	Methyl mercaptan	1.30	1.80			
50	Puente Hills		U	Methyl mercaptan	0.0004	0.007			
60	Sundance Canyon		U	Methyl mercaptan	0.0004	0.007			
41	Guardia de la Guadalupe		U	Methyl mercaptan	12.0	12.6			
41	Guardia de la Guadalupe		U	Methyl mercaptan	4.10	6.11			
54	Arbor Hills		U	Methyl mercaptan	49.6	59.4			
54	Arbor Hills		U	Methyl mercaptan	1469	1594			
54	Arbor Hills		U	Methyl mercaptan	1435	1539			
12	BKK Landfill		>	NMOC (as hexane)	1850	595.381			
12	BKK Landfill		>	NMOC (as hexane)	1850	427.886			
12	BKK Landfill		>	NMOC (as hexane)	1348	457.183			
12	BKK Landfill		>	NMOC (as hexane)	3133	457.183			
12	BKK Landfill		>	NMOC (as hexane)	6902	457.183			
12	BKK Landfill		>	NMOC (as hexane)	3306	457.183			
12	BKK Landfill		>	NMOC (as hexane)	1543	457.183			
12	BKK Landfill		>	NMOC (as hexane)	3392	457.183			
6	Burley PH		U	NMOC (as hexane)	518	780			
6	Burley PH		U	NMOC (as hexane)	757	704			
17	Burley PH		U	NMOC (as hexane)	97	97			
17	Burley PH		U	NMOC (as hexane)	45	49			
17	Burley PH		U	NMOC (as hexane)	407	59			
17	Burley PH		U	NMOC (as hexane)	848	1268			
17	Burley PH		U	NMOC (as hexane)	843	1282			
17	Burley PH		U	NMOC (as hexane)	735	910			
19	Burley PH		U	NMOC (as hexane)	705	881			
19	Burley PH		U	NMOC (as hexane)	202	306			
19	Burley PH		U	NMOC (as hexane)	555	707			
19	Burley PH		U	NMOC (as hexane)	723	932			
19	Burley PH		U	NMOC (as hexane)	717	889			
19	Burley PH		U	NMOC (as hexane)	285	412			
41	Burley PH		U	NMOC (as hexane)	162	940			
41	Burley PH		U	NMOC (as hexane)	352	163			
26	CA		U	NMOC (as hexane)	158	188			
26	CA		U	NMOC (as hexane)	137	2432			
7	Calabasas		U	NMOC (as hexane)	237	2432			
7	Calabasas		U	NMOC (as hexane)	1247	2432			
7	Calabasas		U	NMOC (as hexane)	1435	2432			
7	Calabasas		U	NMOC (as hexane)	2590	2590			
13	Carson		U	NMOC (as hexane)	342	457			
13	Carson		U	NMOC (as hexane)	305	420			
13	Carson		U	NMOC (as hexane)	300	420			
26	FL		U	NMHC (as hexane)	314	319			
26	IL		U	NMHC (as hexane)	210	234			
10	Mission Canyon		U	NMHC (as hexane)	26	105			
5	Mountain Ridge		U	NMHC (as hexane)	88	254			
5	Mountain Ridge		U	NMHC (as hexane)	70	202			
5	Mountain Ridge		U	NMHC (as hexane)	102	230			
5	Mountain Ridge		U	NMHC (as hexane)	80	230			
5	Mountain Ridge		U	NMHC (as hexane)	411	459			
26	Palo Verdes		U	NMHC (as hexane)	475	459			
22	Palo Verdes		U	NMHC (as hexane)	562	4337			
22	Palo Verdes		U	NMHC (as hexane)	190	2065			
22	Palo Verdes		U	NMHC (as hexane)	197	771			
21	Palo Verdes		U	NMHC (as hexane)	210	787			
21	Palo Verdes		U	NMHC (as hexane)	8567	21910			
51	Palo Verdes		U	NMHC (as hexane)	527	1677			
20	Pareseos		U	NMHC (as hexane)	130	167			
20	Pareseos		U	NMHC (as hexane)	147	185			
20	Pareseos		U	NMHC (as hexane)	177	304			
20	Pareseos		U	NMHC (as hexane)	322	548			
20	Pareseos		U	NMHC (as hexane)	59	408			
20	Pareseos		U	NMHC (as hexane)	102	241			
20	Pareseos		U	NMHC (as hexane)	117	233			
20	Pareseos		U	NMHC (as hexane)	138	268			
61	Pine Islands		U	NMHC (as hexane)	145	166			
18	Puente Hills		U	NMHC (as hexane)	322	418			
18	Puente Hills		U	NMHC (as hexane)	368	496			
18	Puente Hills		U	NMHC (as hexane)	342	496			
18	Puente Hills		U	NMHC (as hexane)	308	496			
18	Puente Hills		U	NMHC (as hexane)	1077	1565			
24	Puente Hills		U	NMHC (as hexane)	1035	1485			
24	Puente Hills		U	NMHC (as hexane)	102	1565			
24	Puente Hills		U	NMHC (as hexane)	118	1565			
24	Puente Hills		U	NMHC (as hexane)	120	1565			
24	Puente Hills		U	NMHC (as hexane)	118	1565			
59	Rockingham		U	TGNMHC (hexane)	397	593			
1	Scho Canyon		U	TGNMHC (hexane)	672	1166			
9	Sheraton Street		U	NMOC (as hexane)	480	621			
9	Sheraton Street		U	NMOC (as hexane)	292	388			
9	Sheraton Street		U	NMOC (as hexane)	113	315			
9	Sheraton Street		U	NMOC (as hexane)	49.7	133			

\* Y=Yes, N=No, U=Unknown\*\* Values that are outlined indicate that data from only one landfill were available.

**Appendix B. Default LFG Constituent Concentrations**

Reference	Landfill Name	Co-disposal	(Y, N, or U)*	NMOC (as hexane)	Compound	Raw Concentration (ppmv)	Air Infiltration Corrected Conc. (ppmv)	Site Ave** (ppmv)	Summary Statistics of (ppmv)						Site Averages
									773	772	771	770	771	772	
60	Sunshine Canyon		N	TGNHFC (hexane) TGNHFC (hexene) NHFC (as hexane)	Pentane	456 327	451 321	348 341	3.29	3.29	3.29	3.29	3.29	3.29	Pentane
23	Toyon Canyon	W1	N		Pentane	9.735 9.735			0.70	0.70	0.70	0.70	0.70	0.70	Mean
26	Toyon Canyon		Y		Pentane	3.25 11.1	3.25 11.1	3.25 11.1	1.12	1.12	1.12	1.12	1.12	1.12	Median
43	CBH11		U		Pentane	0.58 1.20	0.58 1.20	0.58 1.20	1.22	1.22	1.22	1.22	1.22	1.22	Standard Deviation
43	CBH13		U		Pentane	0.50 0.53	0.50 0.53	0.50 0.53	0.51	0.51	0.51	0.51	0.51	0.51	Variance
43	CBH14		Y		Pentane	0.53 1.09	0.53 1.09	0.53 1.09	0.51	0.51	0.51	0.51	0.51	0.51	Kurtosis
43	CBH16		U		Pentane	0.53 1.09	0.53 1.09	0.53 1.09	0.51	0.51	0.51	0.51	0.51	0.51	Skewness
43	CBH7		U		Pentane	0.53 1.09	0.53 1.09	0.53 1.09	0.40	0.40	0.40	0.40	0.40	0.40	Range
43	CBH8		U		Pentane	0.53 1.09	0.53 1.09	0.53 1.09	0.40	0.40	0.40	0.40	0.40	0.40	Minimum
43	CBH9		Y		Pentane	0.50 0.62	0.50 0.62	0.50 0.62	0.50	0.50	0.50	0.50	0.50	0.50	Maximum
43	CBH24		Y		Pentane	0.50 0.67	0.50 0.67	0.50 0.67	0.50	0.50	0.50	0.50	0.50	0.50	Mean
43	CBH26		U		Pentane	0.50 0.67	0.50 0.67	0.50 0.67	0.50	0.50	0.50	0.50	0.50	0.50	Median
43	CBH27		U		Pentane	0.50 0.67	0.50 0.67	0.50 0.67	0.50	0.50	0.50	0.50	0.50	0.50	Standard Deviation
43	CBH30		U		Pentane	0.50 0.90	0.50 0.90	0.50 0.90	0.50	0.50	0.50	0.50	0.50	0.50	Variance
43	CBH32		U		Pentane	0.50 1.10	0.50 1.10	0.50 1.10	1.10	1.10	1.10	1.10	1.10	1.10	Kurtosis
43	CBH33		U		Pentane	0.50 1.10	0.50 1.10	0.50 1.10	1.10	1.10	1.10	1.10	1.10	1.10	Skewness
43	CBH5		U		Pentane	0.50 1.80	0.50 1.80	0.50 1.80	1.81	1.81	1.81	1.81	1.81	1.81	Range
43	CBH6		U		Pentane	0.50 1.87	0.50 1.87	0.50 1.87	0.68	0.68	0.68	0.68	0.68	0.68	Minimum
43	CBH8		U		Pentane	0.50 1.87	0.50 1.87	0.50 1.87	0.68	0.68	0.68	0.68	0.68	0.68	Maximum
43	CBH9		U		Pentane	0.50 1.87	0.50 1.87	0.50 1.87	0.68	0.68	0.68	0.68	0.68	0.68	Mean
43	CBH27		U		Pentane	0.50 1.87	0.50 1.87	0.50 1.87	0.68	0.68	0.68	0.68	0.68	0.68	Median
43	CBH30		U		Pentane	0.50 1.87	0.50 1.87	0.50 1.87	0.68	0.68	0.68	0.68	0.68	0.68	Standard Deviation
43	CBH32		U		Pentane	0.50 1.87	0.50 1.87	0.50 1.87	0.68	0.68	0.68	0.68	0.68	0.68	Variance
43	CBH33		U		Pentane	0.50 1.87	0.50 1.87	0.50 1.87	0.68	0.68	0.68	0.68	0.68	0.68	Kurtosis
43	CBH5		U		Pentane	0.50 1.87	0.50 1.87	0.50 1.87	0.68	0.68	0.68	0.68	0.68	0.68	Skewness
43	CBH6		U		Pentane	0.50 1.87	0.50 1.87	0.50 1.87	0.68	0.68	0.68	0.68	0.68	0.68	Range
43	CBH8		U		Pentane	0.50 1.87	0.50 1.87	0.50 1.87	0.68	0.68	0.68	0.68	0.68	0.68	Minimum
43	CBH9		U		Pentane	0.50 1.87	0.50 1.87	0.50 1.87	0.68	0.68	0.68	0.68	0.68	0.68	Maximum
43	CBH27		U		Pentane	0.50 1.87	0.50 1.87	0.50 1.87	0.68	0.68	0.68	0.68	0.68	0.68	Mean
43	CBH30		U		Pentane	0.50 1.87	0.50 1.87	0.50 1.87	0.68	0.68	0.68	0.68	0.68	0.68	Median
43	CBH32		U		Pentane	0.50 1.87	0.50 1.87	0.50 1.87	0.68	0.68	0.68	0.68	0.68	0.68	Standard Deviation
43	CBH33		U		Pentane	0.50 1.87	0.50 1.87	0.50 1.87	0.68	0.68	0.68	0.68	0.68	0.68	Variance
43	CBH5		U		Pentane	0.50 1.87	0.50 1.87	0.50 1.87	0.68	0.68	0.68	0.68	0.68	0.68	Kurtosis
43	CBH6		U		Pentane	0.50 1.87	0.50 1.87	0.50 1.87	0.68	0.68	0.68	0.68	0.68	0.68	Skewness
43	CBH8		U		Pentane	0.50 1.87	0.50 1.87	0.50 1.87	0.68	0.68	0.68	0.68	0.68	0.68	Range
43	CBH9		U		Pentane	0.50 1.87	0.50 1.87	0.50 1.87	0.68	0.68	0.68	0.68	0.68	0.68	Minimum
43	CBH27		U		Pentane	0.50 1.87	0.50 1.87	0.50 1.87	0.68	0.68	0.68	0.68	0.68	0.68	Maximum
43	CBH30		U		Pentane	0.50 1.87	0.50 1.87	0.50 1.87	0.68	0.68	0.68	0.68	0.68	0.68	Mean
43	CBH32		U		Pentane	0.50 1.87	0.50 1.87	0.50 1.87	0.68	0.68	0.68	0.68	0.68	0.68	Median
43	CBH33		U		Pentane	0.50 1.87	0.50 1.87	0.50 1.87	0.68	0.68	0.68	0.68	0.68	0.68	Standard Deviation
43	CBH5		U		Pentane	0.50 1.87	0.50 1.87	0.50 1.87	0.68	0.68	0.68	0.68	0.68	0.68	Variance
43	CBH6		U		Pentane	0.50 1.87	0.50 1.87	0.50 1.87	0.68	0.68	0.68	0.68	0.68	0.68	Kurtosis
43	CBH8		U		Pentane	0.50 1.87	0.50 1.87	0.50 1.87	0.68	0.68	0.68	0.68	0.68	0.68	Skewness
43	CBH9		U		Pentane	0.50 1.87	0.50 1.87	0.50 1.87	0.68	0.68	0.68	0.68	0.68	0.68	Range
43	CBH27		U		Pentane	0.50 1.87	0.50 1.87	0.50 1.87	0.68	0.68	0.68	0.68	0.68	0.68	Minimum
43	CBH30		U		Pentane	0.50 1.87	0.50 1.87	0.50 1.87	0.68	0.68	0.68	0.68	0.68	0.68	Maximum
43	CBH32		U		Pentane	0.50 1.87	0.50 1.87	0.50 1.87	0.68	0.68	0.68	0.68	0.68	0.68	Mean
43	CBH33		U		Pentane	0.50 1.87	0.50 1.87	0.50 1.87	0.68	0.68	0.68	0.68	0.68	0.68	Median
43	CBH5		U		Pentane	0.50 1.87	0.50 1.87	0.50 1.87	0.68	0.68	0.68	0.68	0.68	0.68	Standard Deviation
43	CBH6		U		Pentane	0.50 1.87	0.50 1.87	0.50 1.87	0.68	0.68	0.68	0.68	0.68	0.68	Variance
43	CBH8		U		Pentane	0.50 1.87	0.50 1.87	0.50 1.87	0.68	0.68	0.68	0.68	0.68	0.68	Kurtosis
43	CBH9		U		Pentane	0.50 1.87	0.50 1.87	0.50 1.87	0.68	0.68	0.68	0.68	0.68	0.68	Skewness
43	CBH27		U		Pentane	0.50 1.87	0.50 1.87	0.50 1.87	0.68	0.68	0.68	0.68	0.68	0.68	Range
43	CBH30		U		Pentane	0.50 1.87	0.50 1.87	0.50 1.87	0.68	0.68	0.68	0.68	0.68	0.68	Minimum
43	CBH32		U		Pentane	0.50 1.87	0.50 1.87	0.50 1.87	0.68	0.68	0.68	0.68	0.68	0.68	Maximum
43	CBH33		U		Pentane	0.50 1.87	0.50 1.87	0.50 1.87	0.68	0.68	0.68	0.68	0.68	0.68	Mean
43	CBH5		U		Pentane	0.50 1.87	0.50 1.87	0.50 1.87	0.68	0.68	0.68	0.68	0.68	0.68	Median
43	CBH6		U		Pentane	0.50 1.87	0.50 1.87	0.50 1.87	0.68	0.68	0.68	0.68	0.68	0.68	Standard Deviation
43	CBH8		U		Pentane	0.50 1.87	0.50 1.87	0.50 1.87	0.68	0.68	0.68	0.68	0.68	0.68	Variance
43	CBH9		U		Pentane	0.50 1.87	0.50 1.87	0.50 1.87	0.68	0.68	0.68	0.68	0.68	0.68	Kurtosis
43	CBH27		U		Pentane	0.50 1.87	0.50 1.87	0.50 1.87	0.68	0.68	0.68	0.68	0.68	0.68	Skewness
43	CBH30		U		Pentane	0.50 1.87	0.50 1.87	0.50 1.87	0.68	0.68	0.68	0.68	0.68	0.68	Range
43	CBH32		U		Pentane	0.50 1.87	0.50 1.87	0.50 1.87	0.68	0.68	0.68	0.68	0.68	0.68	Minimum
43	CBH33		U		Pentane	0.50 1.87	0.50 1.87	0.50 1.87	0.68	0.68	0.68	0.68	0.68	0.68	Maximum
43	CBH5		U		Pentane	0.50 1.87	0.50 1.87	0.50 1.87	0.68	0.68	0.68	0.68	0.68	0.68	Mean
43	CBH6		U		Pentane	0.50 1.87	0.50 1.87	0.50 1.87	0.68	0.68	0.68	0.68	0.68	0.68	Median
43	CBH8		U		Pentane	0.50 1.87	0.50 1.87	0.50 1.87	0.68	0.68	0.68	0.68	0.68	0.68	Standard Deviation
43	CBH9		U		Pentane	0.50 1.87	0.50 1.87	0.50 1.87	0.68	0.68	0.68	0.68	0.68	0.68	Variance
43	CBH27		U		Pentane	0.50 1.87	0.50 1.87	0.50 1.87	0.68	0.68	0.68	0.68	0.68	0.68	Kurtosis
43	CBH30		U		Pentane	0.50 1.87	0.50 1.87	0.50 1.87	0.68	0.68	0.68	0.68	0.68	0.68	Skewness
43	CBH32		U		Pentane	0.50 1.87	0.50 1.87	0.50 1.87	0.68	0.68	0.68	0.68	0.68	0.68	Range
43	CBH33		U		Pentane	0.50 1.87	0.50 1.87	0.50 1.87	0.68	0.68	0.68	0.68	0.68	0.68	Minimum

**Appendix B. Default LFG Constituent Concentrations**

Reference	Landfill Name	Co-disposal	(Y, N, or U)*	Compound	Raw Concentration (ppmv)	Air Infiltration Corrected Conc. (ppmv)	Site Ave** (ppmv)	Summary Statistics of (ppmv)		Site Averages
								1.00	1.51	
43	CB32	U	U	Perchloroethylene	12.1	12.7	12.7	1.00	1.53	1.53
43	CB33	U	U	Perchloroethylene	10.5	10.6	10.6	1.00	1.53	1.53
43	CB4	U	U	Perchloroethylene	0.96	0.96	0.96	0.96	0.96	0.96
43	CB5	U	U	Perchloroethylene	7.75	7.94	7.94	7.75	7.94	7.94
43	CB7	U	U	Perchloroethylene	65.0	65.5	65.5	65.0	65.5	65.5
43	CB8	U	U	Perchloroethylene	9.30	9.39	9.39	9.30	9.39	9.39
43	CB9	U	U	Perchloroethylene	2.59	2.04	2.04	2.59	2.04	2.04
43	CB10	U	U	Perchloroethylene	5.31	7.07	7.07	5.31	7.07	7.07
43	CB11	U	U	Perchloroethylene	4.32	6.82	6.82	4.32	6.82	6.82
43	CB12	U	U	Perchloroethylene	4.73	6.30	6.30	4.73	6.30	6.30
43	CB13	U	U	Perchloroethylene	4.86	7.20	7.20	4.86	7.20	7.20
43	CB14	U	U	Perchloroethylene	7.31	11.53	11.53	7.31	11.53	11.53
43	CB15	U	U	Perchloroethylene	9.18	13.6	13.6	9.18	13.6	13.6
43	CB16	U	U	Perchloroethylene	7.60	10.0	10.0	7.60	10.0	10.0
43	CB17	U	U	Perchloroethylene	8.20	9.88	9.88	8.20	9.88	9.88
43	CB18	U	U	Perchloroethylene	9.10	10.8	10.8	9.10	10.8	10.8
43	CB19	U	U	Perchloroethylene	54.4	65.1	65.1	54.4	65.1	65.1
43	CB20	U	U	Perchloroethylene	2.50	3.41	3.41	2.50	3.41	3.41
43	CB21	U	U	Perchloroethylene	4.40	5.24	5.24	4.40	5.24	5.24
43	CB22	U	U	Perchloroethylene	0.00	0.00	0.00	0.00	0.00	0.00
43	CB23	U	U	Perchloroethylene	0.00	0.01	0.01	0.00	0.01	0.01
43	CB24	U	U	Perchloroethylene	2.80	2.80	2.80	2.80	2.80	2.80
43	CB25	U	U	Perchloroethylene	3.18	3.18	3.18	3.18	3.18	3.18
43	CB26	U	U	Perchloroethylene	2.61	3.16	3.16	2.61	3.16	3.16
43	CB27	U	U	Perchloroethylene	3.10	3.54	3.54	3.10	3.54	3.54
43	CB28	U	U	Perchloroethylene	2.94	3.18	3.18	2.94	3.18	3.18
43	CB29	U	U	Perchloroethylene	4.71	4.71	4.71	4.71	4.71	4.71
43	CB30	U	U	Perchloroethylene	0.16	0.70	0.70	0.16	0.70	0.70
43	CB31	U	U	Perchloroethylene	0.42	0.83	0.83	0.42	0.83	0.83
43	CB32	U	U	Perchloroethylene	0.22	0.96	0.96	0.22	0.96	0.96
43	CB33	U	U	Perchloroethylene	0.34	1.48	1.48	0.34	1.48	1.48
43	CB34	U	U	Perchloroethylene	0.09	0.30	0.30	0.09	0.30	0.30
43	CB35	U	U	Perchloroethylene	0.49	2.14	2.14	0.49	2.14	2.14
43	CB36	U	U	Perchloroethylene	0.34	1.48	1.48	0.34	1.48	1.48
43	CB37	U	U	Perchloroethylene	0.15	0.65	0.65	0.15	0.65	0.65
43	CB38	U	U	Perchloroethylene	0.42	1.83	1.83	0.42	1.83	1.83
43	CB39	U	U	Perchloroethylene	0.09	0.41	0.41	0.09	0.41	0.41
43	CB40	U	U	Perchloroethylene	0.52	2.27	2.27	0.52	2.27	2.27
43	CB41	U	U	Perchloroethylene	3.40	10.8	10.8	3.40	10.8	10.8
43	CB42	U	U	Perchloroethylene	2.50	6.39	6.39	2.50	6.39	6.39
43	CB43	U	U	Perchloroethylene	1.50	3.92	3.92	1.50	3.92	3.92
43	CB44	U	U	Perchloroethylene	1.60	2.02	2.02	1.60	2.02	2.02
43	CB45	U	U	Perchloroethylene	3.00	5.16	5.16	3.00	5.16	5.16
43	CB46	U	U	Perchloroethylene	2.20	5.45	5.45	2.20	5.45	5.45
43	CB47	U	U	Perchloroethylene	0.91	2.21	2.21	0.91	2.21	2.21
43	CB48	U	U	Perchloroethylene	0.97	2.29	2.29	0.97	2.29	2.29
43	CB49	U	U	Perchloroethylene	0.64	1.27	1.27	0.64	1.27	1.27
43	CB50	U	U	Perchloroethylene	-0.00	1.95	1.95	-0.00	1.95	1.95
43	CB51	U	U	Perchloroethylene	7.90	10.3	10.3	7.90	10.3	10.3
43	CB52	U	U	Perchloroethylene	8.50	11.5	11.5	8.50	11.5	11.5
43	CB53	U	U	Perchloroethylene	7.40	9.87	9.87	7.40	9.87	9.87
43	CB54	U	U	Perchloroethylene	5.90	7.81	7.81	5.90	7.81	7.81
43	CB55	U	U	Perchloroethylene	8.80	12.7	12.7	8.80	12.7	12.7
43	CB56	U	U	Perchloroethylene	0.94	1.30	1.30	0.94	1.30	1.30
43	CB57	U	U	Perchloroethylene	0.60	1.16	1.16	0.60	1.16	1.16
43	CB58	U	U	Perchloroethylene	0.97	2.20	2.20	0.97	2.20	2.20
43	CB59	U	U	Perchloroethylene	0.64	1.27	1.27	0.64	1.27	1.27
43	CB60	U	U	Perchloroethylene	-0.00	1.95	1.95	-0.00	1.95	1.95
43	CB61	U	U	Perchloroethylene	7.90	10.3	10.3	7.90	10.3	10.3
43	CB62	U	U	Perchloroethylene	8.50	11.5	11.5	8.50	11.5	11.5
43	CB63	U	U	Perchloroethylene	7.40	9.87	9.87	7.40	9.87	9.87
43	CB64	U	U	Perchloroethylene	5.90	7.81	7.81	5.90	7.81	7.81
43	CB65	U	U	Perchloroethylene	8.80	12.7	12.7	8.80	12.7	12.7
43	CB66	U	U	Perchloroethylene	0.94	1.30	1.30	0.94	1.30	1.30
43	CB67	U	U	Perchloroethylene	0.60	1.16	1.16	0.60	1.16	1.16
43	CB68	U	U	Perchloroethylene	0.97	2.20	2.20	0.97	2.20	2.20
43	CB69	U	U	Perchloroethylene	0.64	1.27	1.27	0.64	1.27	1.27
43	CB70	U	U	Perchloroethylene	-0.00	1.95	1.95	-0.00	1.95	1.95
43	CB71	U	U	Perchloroethylene	7.90	10.3	10.3	7.90	10.3	10.3
43	CB72	U	U	Perchloroethylene	8.50	11.5	11.5	8.50	11.5	11.5
43	CB73	U	U	Perchloroethylene	7.40	9.87	9.87	7.40	9.87	9.87
43	CB74	U	U	Perchloroethylene	5.90	7.81	7.81	5.90	7.81	7.81
43	CB75	U	U	Perchloroethylene	8.80	12.7	12.7	8.80	12.7	12.7
43	CB76	U	U	Perchloroethylene	0.94	1.30	1.30	0.94	1.30	1.30
43	CB77	U	U	Perchloroethylene	0.60	1.16	1.16	0.60	1.16	1.16
43	CB78	U	U	Perchloroethylene	0.97	2.20	2.20	0.97	2.20	2.20
43	CB79	U	U	Perchloroethylene	0.64	1.27	1.27	0.64	1.27	1.27
43	CB80	U	U	Perchloroethylene	-0.00	1.95	1.95	-0.00	1.95	1.95
43	CB81	U	U	Perchloroethylene	7.90	10.3	10.3	7.90	10.3	10.3
43	CB82	U	U	Perchloroethylene	8.50	11.5	11.5	8.50	11.5	11.5
43	CB83	U	U	Perchloroethylene	7.40	9.87	9.87	7.40	9.87	9.87
43	CB84	U	U	Perchloroethylene	5.90	7.81	7.81	5.90	7.81	7.81
43	CB85	U	U	Perchloroethylene	8.80	12.7	12.7	8.80	12.7	12.7
43	CB86	U	U	Perchloroethylene	0.94	1.30	1.30	0.94	1.30	1.30
43	CB87	U	U	Perchloroethylene	0.60	1.16	1.16	0.60	1.16	1.16
43	CB88	U	U	Perchloroethylene	0.97	2.20	2.20	0.97	2.20	2.20
43	CB89	U	U	Perchloroethylene	0.64	1.27	1.27	0.64	1.27	1.27
43	CB90	U	U	Perchloroethylene	-0.00	1.95	1.95	-0.00	1.95	1.95
43	CB91	U	U	Perchloroethylene	7.90	10.3	10.3	7.90	10.3	10.3
43	CB92	U	U	Perchloroethylene	8.50	11.5	11.5	8.50	11.5	11.5
43	CB93	U	U	Perchloroethylene	7.40	9.87	9.87	7.40	9.87	9.87
43	CB94	U	U	Perchloroethylene	5.90	7.81	7.81	5.90	7.81	7.81
43	CB95	U	U	Perchloroethylene	8.80	12.7	12.7	8.80	12.7	12.7
43	CB96	U	U	Perchloroethylene	0.94	1.30	1.30	0.94	1.30	1.30
43	CB97	U	U	Perchloroethylene	0.60	1.16	1.16	0.60	1.16	1.16
43	CB98	U	U	Perchloroethylene	0.97	2.20	2.20	0.97	2.20	2.20
43	CB99	U	U	Perchloroethylene	0.64	1.27	1.27	0.64	1.27	1.27
43	CB100	U	U	Perchloroethylene	-0.00	1.95	1.95	-0.00	1.95	1.95
43	CB101	U	U	Perchloroethylene	7.90	10.3	10.3	7.90	10.3	10.3
43	CB102	U	U	Perchloroethylene	8.50	11.5	11.5	8.50	11.5	11.5
43	CB103	U	U	Perchloroethylene	7.40	9.87	9.87	7.40	9.87	9.87
43	CB104	U	U	Perchloroethylene	5.90	7.81	7.81	5.90	7.81	7.81
43	CB105	U	U	Perchloroethylene	8.80	12.7	12.7	8.80	12.7	12.7
43	CB106	U	U	Perchloroethylene	0.94	1.30	1.30	0.94	1.30	1.30
43	CB107	U	U	Perchloroethylene	0.60	1.16	1.16	0.60	1.16	1.16
43	CB108	U	U	Perchloroethylene	0.97	2.20	2.20	0.97	2.20	2.20
43	CB109	U	U	Perchloroethylene	0.64	1.27	1.27	0.64	1.27	1.27
43	CB110	U	U	Perchloroethylene	-0.00	1.95	1.95	-0.00	1.95	1.95
43	CB111	U	U	Perchloroethylene	7.90	10.3	10.3	7.90	10.3	10.3
43	CB112	U	U	Perchloroethylene	8.50	11.5	11.5	8.50	11.5	11.5
43	CB113	U	U	Perchloroethylene	7.40	9.87	9.87	7.40	9.87	9.87
43	CB114	U	U	Perchloroethylene	5.90	7.81	7.81	5.90	7.81	7.81
43	CB115	U	U	Perchloroethylene	8.80	12.7				

## **Appendix B. Default LFG Constituent Concentrations**

Reference	Lindilli Name	Compound	Raw Concentration (ppm)			Air Infiltration Corrected Conc. (ppmv)	Site Avg** (ppmv)	Summary Statistics of (ppmv)			
			(Y, N, or U)	Ocdisposal	Co-disposal			Mean	Median	Standard Deviation	
43	CB33	Propane	U	Propane	Propane	0.63	0.63	2.55	2.11	7.000	7.000
43	CB34	Propane	U	Propane	Propane	43.8	43.8	45.8	45.8	2.830	2.830
43	CB4	Propane	U	Propane	Propane	32.0	32.0	32.3	32.3	32.3	32.3
43	CB5	Propane	U	Propane	Propane	36.5	36.5	36.8	36.8	36.8	36.8
43	CB6	Propane	U	Propane	Propane	25.3	25.3	25.5	25.5	25.5	25.5
43	CB8	Propane	U	Propane	Propane	68.0	68.0	68.7	68.7	68.7	68.7
41	Guadalupe	Propylcaprolate	U	Propylcaprolate	Propylcaprolate	0.25	0.25	0.26	0.26	0.26	0.26
41	Sunshine Canyon	Propylene acetic acid	U	Propylene acetic acid	Propylene acetic acid	34.0	34.0	40.7	40.7	40.7	40.7
41	Guadalupe	Propylene butanoic acid	U	Propylene butanoic acid	Propylene butanoic acid	86.6	86.6	104	104	104	104
41	Breeding Hill	1,1-Dichloroethene	U	1,1-Dichloroethene	1,1-Dichloroethene	9.30	9.30	15.5	15.5	15.5	15.5
19	Bradley Pt.	1,1-Dichloroethene	U	1,1-Dichloroethene	1,1-Dichloroethene	2.40	2.40	3.04	3.04	3.04	3.04
19	Bradley Pt.	1,1-Dichloroethene	U	1,1-Dichloroethene	1,1-Dichloroethene	1.10	1.10	13.6	13.6	13.6	13.6
6	Bradley Pt.	1,1-Dichloroethene	U	1,1-Dichloroethene	1,1-Dichloroethene	1.78	1.78	1.78	1.78	1.78	1.78
6	Bradley Pt.	1,1-Dichloroethene	U	1,1-Dichloroethene	1,1-Dichloroethene	0.60	0.60	0.60	0.60	0.60	0.60
7	Calabasas	1,1-Dichloroethene	Y	1,1-Dichloroethene	1,1-Dichloroethene	52.0	52.0	63.9	63.9	63.9	63.9
43	CB10	1,1-Dichloroethene	U	1,1-Dichloroethene	1,1-Dichloroethene	6.32	6.32	6.32	6.32	6.32	6.32
43	CB11	1,1-Dichloroethene	U	1,1-Dichloroethene	1,1-Dichloroethene	18.5	18.5	18.7	18.7	18.7	18.7
43	CB12	1,1-Dichloroethene	U	1,1-Dichloroethene	1,1-Dichloroethene	5.27	5.27	5.31	5.31	5.31	5.31
43	CB13	1,1-Dichloroethene	U	1,1-Dichloroethene	1,1-Dichloroethene	0.13	0.13	0.16	0.16	0.16	0.16
43	CB14	1,1-Dichloroethene	U	1,1-Dichloroethene	1,1-Dichloroethene	8.98	8.98	9.88	9.88	9.88	9.88
43	CB15	1,1-Dichloroethene	U	1,1-Dichloroethene	1,1-Dichloroethene	0.38	0.38	0.34	0.34	0.34	0.34
43	CB17	1,1-Dichloroethene	U	1,1-Dichloroethene	1,1-Dichloroethene	1.65	1.65	1.67	1.67	1.67	1.67
43	CB18	1,1-Dichloroethene	U	1,1-Dichloroethene	1,1-Dichloroethene	7.82	7.82	7.98	7.98	7.98	7.98
43	CB19	1,1-Dichloroethene	U	1,1-Dichloroethene	1,1-Dichloroethene	0.30	0.30	0.30	0.30	0.30	0.30
43	CB2	1,1-Dichloroethene	U	1,1-Dichloroethene	1,1-Dichloroethene	0.25	0.25	0.25	0.25	0.25	0.25
43	CB20	1,1-Dichloroethene	U	1,1-Dichloroethene	1,1-Dichloroethene	5.45	5.45	5.48	5.48	5.48	5.48
43	CB21	1,1-Dichloroethene	U	1,1-Dichloroethene	1,1-Dichloroethene	2.78	2.78	2.80	2.80	2.80	2.80
43	CB22	1,1-Dichloroethene	U	1,1-Dichloroethene	1,1-Dichloroethene	6.23	6.23	6.29	6.29	6.29	6.29
43	CB23	1,1-Dichloroethene	U	1,1-Dichloroethene	1,1-Dichloroethene	13.00	13.00	13.80	13.80	13.80	13.80
43	CB24	1,1-Dichloroethene	Y	1,1-Dichloroethene	1,1-Dichloroethene	4.55	4.55	4.62	4.62	4.62	4.62
43	CB25	1,1-Dichloroethene	U	1,1-Dichloroethene	1,1-Dichloroethene	0.36	0.36	0.36	0.36	0.36	0.36
43	CB27	1,1-Dichloroethene	U	1,1-Dichloroethene	1,1-Dichloroethene	3.99	3.99	3.99	3.99	3.99	3.99
43	CB28	1,1-Dichloroethene	U	1,1-Dichloroethene	1,1-Dichloroethene	1.20	1.20	1.20	1.20	1.20	1.20
43	CB29	1,1-Dichloroethene	U	1,1-Dichloroethene	1,1-Dichloroethene	11.49	11.49	12.16	12.16	12.16	12.16
43	CB30	1,1-Dichloroethene	U	1,1-Dichloroethene	1,1-Dichloroethene	0.60	0.60	0.60	0.60	0.60	0.60
43	CB31	1,1-Dichloroethene	U	1,1-Dichloroethene	1,1-Dichloroethene	0.11	0.11	0.11	0.11	0.11	0.11
43	CB32	1,1-Dichloroethene	U	1,1-Dichloroethene	1,1-Dichloroethene	8.80	8.80	8.82	8.82	8.82	8.82
43	CB33	1,1-Dichloroethene	U	1,1-Dichloroethene	1,1-Dichloroethene	1.21	1.21	1.21	1.21	1.21	1.21
43	CB34	1,1-Dichloroethene	U	1,1-Dichloroethene	1,1-Dichloroethene	2.88	2.88	2.88	2.88	2.88	2.88
43	CB35	1,1-Dichloroethene	U	1,1-Dichloroethene	1,1-Dichloroethene	0.50	0.50	0.50	0.50	0.50	0.50
43	CB36	1,1-Dichloroethene	U	1,1-Dichloroethene	1,1-Dichloroethene	7.42	7.42	7.42	7.42	7.42	7.42
43	CB37	1,1-Dichloroethene	U	1,1-Dichloroethene	1,1-Dichloroethene	0.90	0.90	0.91	0.91	0.91	0.91
43	CB38	1,1-Dichloroethene	U	1,1-Dichloroethene	1,1-Dichloroethene	1.38	1.38	1.38	1.38	1.38	1.38
43	CB39	1,1-Dichloroethene	U	1,1-Dichloroethene	1,1-Dichloroethene	1.31	1.31	1.31	1.31	1.31	1.31
43	CB40	1,1-Dichloroethene	U	1,1-Dichloroethene	1,1-Dichloroethene	0.90	0.90	0.91	0.91	0.91	0.91
27	Lyon Development	1,1-Dichloroethene	U	1,1-Dichloroethene	1,1-Dichloroethene	0.20	0.20	0.24	0.24	0.24	0.24
27	Mountingade	1,1-Dichloroethene	U	1,1-Dichloroethene	1,1-Dichloroethene	0.41	0.41	0.49	0.49	0.49	0.49
5	Mountingade	1,1-Dichloroethene	N	1,1-Dichloroethene	1,1-Dichloroethene	0.060	0.060	0.23	0.23	0.23	0.23
5	Mountingade	1,1-Dichloroethene	N	1,1-Dichloroethene	1,1-Dichloroethene	0.080	0.080	0.23	0.23	0.23	0.23
5	Mountingade	1,1-Dichloroethene	N	1,1-Dichloroethene	1,1-Dichloroethene	0.080	0.080	0.23	0.23	0.23	0.23
20	Pencose	1,1-Dichloroethene	U	1,1-Dichloroethene	1,1-Dichloroethene	1.50	1.50	1.52	1.52	1.52	1.52
20	Pencose	1,1-Dichloroethene	U	1,1-Dichloroethene	1,1-Dichloroethene	1.50	1.50	1.52	1.52	1.52	1.52
20	Pencose	1,1-Dichloroethene	U	1,1-Dichloroethene	1,1-Dichloroethene	1.50	1.50	1.52	1.52	1.52	1.52
20	Pencose	1,1-Dichloroethene	U	1,1-Dichloroethene	1,1-Dichloroethene	1.50	1.50	1.52	1.52	1.52	1.52
20	Pencose	1,1-Dichloroethene	U	1,1-Dichloroethene	1,1-Dichloroethene	1.50	1.50	1.52	1.52	1.52	1.52
20	Pencose	1,1-Dichloroethene	U	1,1-Dichloroethene	1,1-Dichloroethene	1.50	1.50	1.52	1.52	1.52	1.52
18	Purina Hills	1,1-Dichloroethene	N	1,1-Dichloroethene	1,1-Dichloroethene	17.0	17.0	22.1	22.1	22.1	22.1
18	Purina Hills	1,1-Dichloroethene	N	1,1-Dichloroethene	1,1-Dichloroethene	17.0	17.0	22.2	22.2	22.2	22.2
18	Purina Hills	1,1-Dichloroethene	N	1,1-Dichloroethene	1,1-Dichloroethene	17.0	17.0	22.5	22.5	22.5	22.5
41	Guadalupe	Tetrahydrodibenzofuran	U	Tetrahydrodibenzofuran	Tetrahydrodibenzofuran	3.40	3.40	4.07	4.07	4.07	4.07
41	Actor Hills	Thiobenzethane	U	Thiobenzethane	Thiobenzethane	10.6	10.6	12.7	12.7	12.7	12.7
54	Actor Hills	Toluene	U	Toluene	Toluene	69.5	69.5	70.3	70.3	70.3	70.3
54	Actor Hills	Toluene	U	Toluene	Toluene	68.9	68.9	68.9	68.9	68.9	68.9
15	Azusa Land Reclamation	Azusa Land Reclamation	U	Azusa Land Reclamation	Azusa Land Reclamation	21.0	21.0	21.9	21.9	21.9	21.9
15	Azusa Land Reclamation	Azusa Land Reclamation	U	Azusa Land Reclamation	Azusa Land Reclamation	45.9	45.9	46.9	46.9	46.9	46.9
15	Azusa Land Reclamation	Azusa Land Reclamation	U	Azusa Land Reclamation	Azusa Land Reclamation	29.0	29.0	32.0	32.0	32.0	32.0
15	Azusa Land Reclamation	Azusa Land Reclamation	U	Azusa Land Reclamation	Azusa Land Reclamation	53.0	53.0	55.3	55.3	55.3	55.3
15	Azusa Land Reclamation	Azusa Land Reclamation	U	Azusa Land Reclamation	Azusa Land Reclamation	46.0	46.0	48.0	48.0	48.0	48.0
15	Azusa Land Reclamation	Azusa Land Reclamation	U	Azusa Land Reclamation	Azusa Land Reclamation	38.0	38.0	40.0	40.0	40.0	40.0
15	Azusa Land Reclamation	Azusa Land Reclamation	U	Azusa Land Reclamation	Azusa Land Reclamation	28.0	28.0	29.2	29.2	29.2	29.2
						Mean	Mean	Median	Median	Standard Deviation	Standard Deviation
						Variance	Variance	Kurtosis	Kurtosis	Skewness	Skewness
						Range	Range	Maximum	Maximum	Minimum	Minimum
						Sum	Sum	Total	Total	Total (co-disposal)	Total (co-disposal)

\* Y=Yes, N=No, U=Unknown\*\* Values that are outlined indicate that data from only one landfill were available.

**Appendix B. Default LFG Constituent Concentrations**

Reference	Aerial Land Reclamation	Landfill Name	Co-disposal	(Y, N, or U)*	Toluene	Compound	Raw Concentration (ppm)	Air Infiltration Corrected Conc. (ppm)	Site Avg.** (ppm)	Summary Statistics of (ppm)	Site Averages
15	BKK Landfill	BKK Landfill	U	Y	Toluene	Toluene	31.0	180	32.3	5,000	> 20
12	BKK Landfill	BKK Landfill	U	Y	Toluene	Toluene	120	305	306	39,322	59,147
12	BKK Landfill	BKK Landfill	U	Y	Toluene	Toluene	200	440	440	69,841	69,841
17	Bradley PI	Bradley PI	U	U	Toluene	Toluene	30.0	30.0	50.8	7,016	7,016
17	Bradley PI	Bradley PI	U	U	Toluene	Toluene	15.0	15.0	18.8	2,954	2,954
17	Bradley PI	Bradley PI	U	U	Toluene	Toluene	14.0	14.0	17.5	3,986	3,986
17	Bradley PI	Bradley PI	U	U	Toluene	Toluene	24.0	24.0	28.7	41.4	41.4
17	Bradley PI	Bradley PI	U	U	Toluene	Toluene	24.0	24.0	27.0	41.4	41.4
41	BBDI PI	BBDI PI	U	U	Toluene	Toluene	45.0	650	650	30,636	30,636
41	BBDI PI	BBDI PI	U	U	Toluene	Toluene	45.0	650	650	30,636	30,636
6	Bradley PI	Bradley PI	U	U	Toluene	Toluene	26.0	26.0	32.5	51,000	51,000
6	Bradley PI	Bradley PI	U	U	Toluene	Toluene	18.0	18.0	24.5	< 0.1	< 0.1
7	Calabasas	Calabasas	U	Y	Toluene	Toluene	196	299	299	256	256
7	Calabasas	Calabasas	U	Y	Toluene	Toluene	110	199	199	31.1	31.1
13	Carson	Carson	U	U	Toluene	Toluene	150	271	271	43.0	43.0
13	Carson	Carson	U	U	Toluene	Toluene	24.0	50.4	50.4	30.4	30.4
43	CBH 0	CBH 0	U	U	Toluene	Toluene	16.0	19.3	19.3	61.6	61.6
43	CBH 1	CBH 1	U	U	Toluene	Toluene	16.0	21.4	21.4	14.6	14.6
43	CBH 2	CBH 2	U	U	Toluene	Toluene	70.8	72.8	72.8	17.5	17.5
43	CBH 3	CBH 3	U	U	Toluene	Toluene	51.5	52.1	52.1	3.03	3.03
43	CBH 4	CBH 4	U	U	Toluene	Toluene	40.0	44.4	44.4	2.11	2.11
43	CBH 5	CBH 5	U	U	Toluene	Toluene	35.5	42.1	42.1	2.11	2.11
43	CBH 6	CBH 6	U	U	Toluene	Toluene	60.9	61.0	61.0	3.03	3.03
43	CBH 7	CBH 7	U	U	Toluene	Toluene	-0.45	-1.45	-1.45	0.05	0.05
43	CBH 8	CBH 8	U	U	Toluene	Toluene	7.0	17.2	17.2	0.05	0.05
43	CBH 9	CBH 9	U	U	Toluene	Toluene	3.00	7.72	7.72	0.05	0.05
43	CB2	CB2	U	U	Toluene	Toluene	2.10	2.11	2.11	0.05	0.05
43	CB20	CB20	U	U	Toluene	Toluene	2.52	2.52	2.52	0.05	0.05
43	CB21	CB21	U	U	Toluene	Toluene	47.5	47.8	47.8	0.05	0.05
43	CB22	CB22	U	U	Toluene	Toluene	19.4	19.5	19.5	0.05	0.05
43	CB23	CB23	U	U	Toluene	Toluene	23.3	23.5	23.5	0.05	0.05
43	CB24	CB24	U	U	Toluene	Toluene	37.0	39.3	39.3	0.05	0.05
43	CB25	CB25	U	U	Toluene	Toluene	125	127	127	0.05	0.05
43	CB26	CB26	U	U	Toluene	Toluene	22.1	22.3	22.3	0.05	0.05
43	CB27	CB27	U	U	Toluene	Toluene	13.9	14.0	14.0	0.05	0.05
43	CB28	CB28	U	U	Toluene	Toluene	-1.05	1.05	1.05	0.05	0.05
43	CB29	CB29	U	U	Toluene	Toluene	347	367	367	0.05	0.05
43	CB3	CB3	U	U	Toluene	Toluene	19.0	19.0	19.0	0.05	0.05
43	CB30	CB30	U	U	Toluene	Toluene	123	124	124	0.05	0.05
43	CB31	CB31	U	U	Toluene	Toluene	53.1	53.1	53.1	0.05	0.05
43	CB32	CB32	U	U	Toluene	Toluene	12.7	12.8	12.8	0.05	0.05
43	CB33	CB33	U	U	Toluene	Toluene	2.3	2.3	2.3	0.05	0.05
43	CB34	CB34	U	U	Toluene	Toluene	0.65	0.65	0.65	0.05	0.05
43	CB35	CB35	U	U	Toluene	Toluene	27.9	30.8	30.8	0.05	0.05
43	CB36	CB36	U	U	Toluene	Toluene	43.9	43.9	43.9	0.05	0.05
43	CB37	CB37	U	U	Toluene	Toluene	10.1	10.1	10.1	0.05	0.05
43	CB38	CB38	U	U	Toluene	Toluene	68.5	70.2	70.2	0.05	0.05
43	CB39	CB39	U	U	Toluene	Toluene	31.0	51.4	51.4	0.05	0.05
55	Citopepe	Citopepe	U	U	Toluene	Toluene	30.0	30.3	30.3	0.05	0.05
56	Coyote Canyon	Coyote Canyon	U	U	Toluene	Toluene	119	153	153	0.05	0.05
56	Coyote Canyon	Coyote Canyon	U	U	Toluene	Toluene	57.5	76.6	76.6	0.05	0.05
56	Coyote Canyon	Coyote Canyon	U	U	Toluene	Toluene	59.8	79.0	79.0	0.05	0.05
56	Guarida Verde	Guarida Verde	U	U	Toluene	Toluene	90.4	95.9	95.9	0.05	0.05
41	Lyon Development	Lyon Development	U	U	Toluene	Toluene	95.2	98.4	98.4	0.05	0.05
27	Lyon Development	Lyon Development	U	U	Toluene	Toluene	160	182	182	0.05	0.05
27	Lyon Development	Lyon Development	U	U	Toluene	Toluene	32.0	37.6	37.6	0.05	0.05
10	Mission Canyon	Mission Canyon	U	U	Toluene	Toluene	0.40	27.4	27.4	0.05	0.05
5	Mountaintop	Mountaintop	N	Y	Toluene	Toluene	0.05	0.40	0.40	0.05	0.05
5	Mountaintop	Mountaintop	N	Y	Toluene	Toluene	1.90	5.49	5.49	0.05	0.05
5	Mountaintop	Mountaintop	N	Y	Toluene	Toluene	1.80	5.46	5.46	0.05	0.05
5	Mountaintop	Mountaintop	N	Y	Toluene	Toluene	1.90	8.91	8.91	0.05	0.05
8	Operating Industries	Operating Industries	N	Y	Toluene	Toluene	3.56	112	112	0.05	0.05
22	Pales Verdes	Pales Verdes	N	Y	Toluene	Toluene	0.50	4.36	4.36	0.05	0.05
22	Pales Verdes	Pales Verdes	N	Y	Toluene	Toluene	1.50	4.36	4.36	0.05	0.05
22	Pales Verdes	Pales Verdes	N	Y	Toluene	Toluene	4.30	18.7	18.7	0.05	0.05
22	Pales Verdes	Pales Verdes	N	Y	Toluene	Toluene	5.10	48.0	48.0	0.05	0.05
22	Pales Verdes	Pales Verdes	N	Y	Toluene	Toluene	5.50	52.3	52.3	0.05	0.05
22	Pales Verdes	Pales Verdes	N	Y	Toluene	Toluene	19.0	82.8	82.8	0.05	0.05
22	Pales Verdes	Pales Verdes	N	Y	Toluene	Toluene	3.90	17.0	17.0	0.05	0.05
22	Pales Verdes	Pales Verdes	N	Y	Toluene	Toluene	9.50	41.4	41.4	0.05	0.05

\* Y=Yes, N=No, U=Unknown\*\* Values that are outlined indicate that data from only one landfill were available.

## **Appendix B. Default LFG Constituent Concentrations**

Reference	Landfill Name	Co-disposal	(Y, N, or U)*	Compound	Summary Statistics of (ppmv)			
					Raw Concentration (ppmv)	Air Infiltration Corrected Conc. (ppmv)	Site Avg ** (ppmv)	Site Averages
22	Puerto Verdes	Y	Y	Toluene	100	10.0	2.56	
22	Puerto Verdes	Y	Y	Toluene	100	10.0	2.56	
51	Puerto Verdes	Y	Y	Toluene	22.0	70.1	70.1	
51	Puerto Verdes	Y	Y	Toluene	22.0	174	28.2	49.8
20	Pencose	U	U	Toluene	20	21.0	26.5	
20	Pencose	U	U	Toluene	20	42.0	72.3	
20	Pencose	U	U	Toluene	20	68.0	116	
20	Pencose	U	U	Toluene	20	14.0	34.1	
20	Pencose	U	U	Toluene	20	15.0	35.5	
20	Pencose	U	U	Toluene	20	16.0	31.8	
20	Pencose	U	U	Toluene	20	28.0	54.6	
16	Puente Hills	N	N	Toluene	100	100	24	212
16	Puente Hills	N	N	Toluene	100	100	250	
18	Puente Hills	N	N	Toluene	240	320		
18	Puente Hills	N	N	Toluene	240	320		
24	Puente Hills	N	N	Toluene	305	305		
24	Puente Hills	N	N	Toluene	57.5	55.5		
50	Puente Hills	N	N	Toluene	76.9	121		
59	Rockingham	U	U	Toluene	100	99	132	121
1	Scholl Canyon	N	N	Toluene	132	132	46.3	
1	Scholl Canyon	N	N	Toluene	132	132	46.3	
9	Sheldon Street	U	U	Toluene	17.2	17.2		
9	Sheldon Street	U	U	Toluene	20.0	20.0		
9	Sheldon Street	U	U	Toluene	39.8	39.8		
9	Sheldon Street	U	U	Toluene	77.6	77.6		
0	Sunshine Canyon	N	N	Toluene	3.00	3.00		
23	Toyon Canyon	N	N	Toluene	105	105		
53	Alamont	U	U	Trichloroethylene	8.40	9.03		
53	Alamont	U	U	Trichloroethylene	8.31	9.03		
53	Alamont	U	U	Trichloroethylene	8.31	9.03		
53	Arbor Hills	U	U	Trichloroethylene	3.10	4.95		
53	Arbor Hills	U	U	Trichloroethylene	5.00	5.92		
53	Arbor Hills	U	U	Trichloroethylene	5.00	5.92		
53	Arbor Hills	U	U	Trichloroethylene	4.37	4.47		
53	Arbor Hills	U	U	Trichloroethylene	4.14	4.18		
53	Arbor Hills	U	U	Trichloroethylene	4.00	4.08		
15	Azusa Land Remediation	U	U	Trichloroethylene	4.00	4.44		
15	Azusa Land Remediation	U	U	Trichloroethylene	4.20	4.44		
15	Azusa Land Recclamation	U	U	Tetrachloroethylene	3.40	3.55		
15	Azusa Land Recclamation	U	U	Tetrachloroethylene	3.40	3.55		
15	Azusa Land Recclamation	U	U	Tetrachloroethylene	3.30	3.55		
15	Azusa Land Recclamation	U	U	Tetrachloroethylene	3.30	3.55		
15	Azusa Land Recclamation	U	U	Tetrachloroethylene	3.50	3.55		
15	Azusa Land Recclamation	U	U	Tetrachloroethylene	3.50	3.55		
15	Azusa Land Recclamation	U	U	Tetrachloroethylene	3.50	3.55		
15	Azusa Land Recclamation	U	U	Tetrachloroethylene	3.50	3.55		
12	BKK Landfill	U	U	Tetrachloroethylene	3.70	3.86		
12	BKK Landfill	U	U	Tetrachloroethylene	0.59	0.62		
12	BKK Landfill	U	U	Tetrachloroethylene	13.0	28.6		28.7
12	BKK Landfill	U	U	Tetrachloroethylene	4.80	4.80		
17	Bradley Pt	U	U	Tetrachloroethylene	2.10	46.2		
17	Bradley Pt	U	U	Tetrachloroethylene	5.90	5.90		
17	Bradley Pt	U	U	Tetrachloroethylene	2.40	3.50		
17	Bradley Pt	U	U	Tetrachloroethylene	1.80	2.88		
17	Bradley Pt	U	U	Tetrachloroethylene	6.20	7.50		
17	Bradley Pt	U	U	Tetrachloroethylene	6.50	7.72		
17	Bradley Pt	U	U	Tetrachloroethylene	5.50	6.50		
19	Bradley Pt	U	U	Tetrachloroethylene	12.0	12.0		
19	Bradley Pt	U	U	Tetrachloroethylene	12.0	21.7		
19	Bradley Pt	U	U	Tetrachloroethylene	12.0	21.7		
19	Bradley Pt	U	U	Tetrachloroethylene	12.0	21.7		
19	Bradley Pt	U	U	Tetrachloroethylene	12.0	21.7		
19	Bradley Pt	U	U	Tetrachloroethylene	12.0	21.7		
6	Bradley Pt	U	U	Tetrachloroethylene	1.17	2.23		
6	Bradley Pt	U	U	Tetrachloroethylene	4.60	5.71		
6	Bradley Pt	U	U	Tetrachloroethylene	5.10	6.67		
6	Bradley Pt	U	U	Tetrachloroethylene	0.20	0.29		
43	Carson	U	U	Tetrachloroethylene	4.63	3.70		
43	Carson	U	U	Tetrachloroethylene	1.54	1.54		
43	Carson	U	U	Tetrachloroethylene	1.00	0.27		
43	Carson	U	U	Tetrachloroethylene	0.98	0.98		
43	Carson	U	U	Tetrachloroethylene	0.95	0.95		
43	Carson	U	U	Tetrachloroethylene	0.95	0.95		
43	Carson	U	U	Tetrachloroethylene	0.95	0.95		
43	Carson	U	U	Tetrachloroethylene	0.95	0.95		
43	CB110	U	U	Tetrachloroethylene	0.95	0.95		
43	CB111	U	U	Tetrachloroethylene	3.25	3.31		
43	CB112	U	U	Tetrachloroethylene	21.5	21.7		
43	CB113	U	U	Tetrachloroethylene	1.70	1.70		
43	CB114	U	U	Tetrachloroethylene	0.22	0.27		
43	CB115	U	U	Tetrachloroethylene	6.96	7.04		
43	CB116	U	U	Tetrachloroethylene	0.18	0.18		
43	CB117	U	U	Tetrachloroethylene	0.00	0.00		
43	CB118	U	U	Tetrachloroethylene	0.50	0.50		
43	CB119	U	U	Tetrachloroethylene	5.23	5.34		
43	CB120	U	U	Tetrachloroethylene	0.15	0.15		
43	CB121	U	U	Tetrachloroethylene	0.20	0.20		
43	CB122	U	U	Tetrachloroethylene	3.75	3.77		
43	CB123	U	U	Tetrachloroethylene	1.38	1.39		
43	CB124	U	U	Tetrachloroethylene	1.63	1.64		

\* Y=Yes, N=No, U=Unknown\*\* Values that are outlined indicate that data from only one landfill were available.

**Appendix B. Default LFG Constituent Concentrations**

Reference	Landfill Name	Co-disposal	(Y, N, or U)*	Compound	Raw Concentration (ppm)	Air Infiltration Corrected Conc. (ppm)	Site Avg. ** (ppm)	Summary Statistics of (ppm)	Site Averages
43	CB23	U	Y	Trichloroethene	3.10	3.29	3.29		
43	CB24	U	Y	Trichloroethene	13.0	13.2	7.32		
43	CB25	U	Y	Trichloroethene	7.85	7.91	7.91		
43	CB26	U	Y	Trichloroethene	0.20	0.20	0.20		
43	CB27	U	Y	Trichloroethene	1.67	1.68	1.68		
43	CB28	U	Y	Trichloroethene	2.02	2.04	2.04		
43	CB29	U	Y	Trichloroethene	1.80	1.80	1.80		
43	CB30	U	Y	Trichloroethene	1.55	1.56	1.56		
43	CB31	U	Y	Trichloroethene	0.50	0.50	0.50		
43	CB32	U	Y	Trichloroethene	1.50	1.50	1.50		
43	CB33	U	Y	Trichloroethene	1.44	1.44	1.44		
43	CB34	U	Y	Trichloroethene	3.05	3.05	3.05		
43	CB35	U	Y	Trichloroethene	3.08	3.08	3.08		
43	CB36	U	Y	Trichloroethene	0.45	0.45	0.45		
43	CB37	U	Y	Trichloroethene	4.70	4.82	4.82		
43	CB38	U	Y	Trichloroethene	7.80	7.86	7.86		
43	CB39	U	Y	Trichloroethene	3.40	3.43	3.43		
43	Chicope	U	Y	Trichloroethene	2.20	2.82	2.82		
55	Coyote Canyon	U	Y	Trichloroethene	2.38	3.17	3.16		
56	Coyote Canyon	U	Y	Trichloroethene	2.23	2.23	2.97		
56	Coyote Canyon	U	Y	Trichloroethene	2.47	2.47	2.47		
56	Coyote Canyon	U	Y	Trichloroethene	2.37	2.37	3.51		
56	Coyote Canyon	U	Y	Trichloroethene	3.01	4.39	4.39		
55	Coyote Canyon	U	Y	Trichloroethene	0.86	4.55	4.55		
55	Durham Rd.	U	Y	Trichloroethene	2.50	2.59	2.59		
57	Durham Rd.	U	Y	Trichloroethene	2.80	3.13	3.13		
57	Durham Rd.	U	Y	Trichloroethene	2.70	3.21	3.21		
57	Durham Rd.	U	Y	Trichloroethene	2.80	3.19	3.19		
57	Guadalupe	U	Y	Trichloroethene	18.7	22.4	22.4		
41	Lyon Development	U	Y	Trichloroethene	2.80	3.06	3.06		
27	Lyon Development	U	Y	Trichloroethene	2.80	3.33	3.33		
10	Mission Canyon	N	N	Trichloroethene	0.040	0.040	0.040		
5	Mountain Ridge	N	N	Trichloroethene	0.0062	0.026	0.026		
5	Mountain Ridge	N	N	Trichloroethene	0.54	1.55	1.55		
5	Mountain Ridge	N	N	Trichloroethene	0.62	1.79	1.79		
5	Mountain Ridge	N	N	Trichloroethene	0.60	1.73	1.73		
5	Mountain Ridge	N	N	Trichloroethene	0.63	1.87	1.87		
8	Operational Materials	U	Y	Trichloroethene	1.20	2.30	2.39		
58	City Annex	U	Y	Trichloroethene	2.09	2.84	2.84		
84	City Landfill	U	Y	Trichloroethene	2.23	3.49	3.49		
22	Paisley Verdes	Y	Y	Trichloroethene	0.36	1.57	1.57		
22	Paisley Verdes	Y	Y	Trichloroethene	0.29	1.26	1.26		
22	Paisley Verdes	Y	Y	Trichloroethene	0.32	1.40	1.40		
22	Paisley Verdes	Y	Y	Trichloroethene	0.31	1.57	1.57		
22	Paisley Verdes	Y	Y	Trichloroethene	0.36	1.57	1.57		
22	Paisley Verdes	Y	Y	Trichloroethene	0.28	1.22	1.22		
22	Paisley Verdes	Y	Y	Trichloroethene	0.20	0.87	0.87		
22	Paisley Verdes	Y	Y	Trichloroethene	0.19	0.83	0.83		
22	Paisley Verdes	Y	Y	Trichloroethene	0.28	1.26	1.26		
22	Paisley Verdes	Y	Y	Trichloroethene	0.15	0.65	0.65		
22	Paisley Verdes	Y	Y	Trichloroethene	0.24	1.48	1.48		
22	Paisley Verdes	Y	Y	Trichloroethene	0.09	0.38	0.38		
51	Paisley Verdes	Y	Y	Trichloroethene	0.91	2.33	2.33		
20	Pareose	U	Y	Trichloroethene	0.98	3.12	3.12		
20	Pareose	U	Y	Trichloroethene	1.20	1.54	1.54		
20	Pareose	U	Y	Trichloroethene	1.30	1.64	1.64		
20	Pareose	U	Y	Trichloroethene	3.27	3.41	3.41		
20	Pareose	U	Y	Trichloroethene	0.65	1.58	1.58		
20	Pareose	U	Y	Trichloroethene	0.68	1.61	1.61		
20	Pareose	U	Y	Trichloroethene	0.57	1.21	1.21		
20	Puente Hills	U	Y	Trichloroethene	0.45	1.46	1.46		
18	Puente Hills	N	N	Trichloroethene	5.90	5.60	5.60		
18	Puente Hills	N	N	Trichloroethene	4.30	5.80	5.80		
18	Puente Hills	N	N	Trichloroethene	3.60	5.73	5.73		
24	Puente Hills	N	N	Trichloroethene	4.40	6.35	6.35		
24	Puente Hills	N	N	Trichloroethene	0.75	1.03	1.03		
59	Rockingham	U	Y	Trichloroethene	13.0	15.8	15.8		
1	School Canyon	U	Y	Trichloroethene	5.30	7.05	7.05		
1	School Canyon	U	Y	Trichloroethene	2.10	3.37	3.37		
9	Shadow Street	U	Y	Trichloroethene	0.19	0.43	0.43		
9	Shadow Street	U	Y	Trichloroethene	0.19	0.38	0.38		
9	Shadow Street	U	Y	Trichloroethene	0.07	0.07	0.07		
9	Shadow Street	U	Y	Trichloroethene	0.19	0.38	0.38		
9	Shadow Street	U	Y	Trichloroethene	1.20	2.39	2.39		
60	Sunbeam Canyon	U	Y	Trichloroethene	2.53	2.53	2.53		
23	Toyon Canyon	U	Y	Vinyl chloride	0.86	0.92	0.92		
10	Mission Canyon	N	N	Vinyl chloride	0.05	0.22	0.22		
5	Mountaintop	N	N	Vinyl chloride	4.40	12.6	12.6		
5	Mountaintop	N	N	Vinyl chloride	4.20	12.7	12.7		
5	Mountaintop	N	N	Vinyl chloride	4.40	12.6	12.6		

Mean	Median	Standard Deviation	Variance	Kurtosis
13.200	7.340	7.340	51.266	97.548
42.32	42.34	6.241	225.215	
225.334	225.334	0.129	225.334	
Mean	Median	Standard Deviation	Variance	Kurtosis
Range	Range	Range	Range	Range
Minimum	Minimum	Minimum	Minimum	Minimum
Maximum	Maximum	Maximum	Maximum	Maximum

\* Y=Yes, N=No, U=Unknown\*\* Values that are outlined indicate that data from only one landfill were available.

**Appendix B. Default LFG Constituent Concentrations**

Reference	Landfill Name	Co-disposal	(Y, N, or U)*	Compound	Raw Concentration (ppmv)	Air Infiltration Corrected Conc. (ppmv)	Site Ave** (ppmv)	Summary Statistics of (ppmv)	Site Averages
18	Puente Hills		N	Vinyl chloride	18.0	23.4	24.3	725,445 53,000	
18	Puente Hills		N	Vinyl chloride	15.0	24.3	20.0		<.01
18	Puente Hills		N	Vinyl chloride	14.0	20.0	18.5		
24	Puente Hills		N	Vinyl chloride	6.0	9.28	9.81		
24	Puente Hills		N	Vinyl chloride	6.70	9.40	11.4		
50	Puente Hills		N	Vinyl chloride	6.70	6.70	10.8		10.1
1	Schob Canyon		N	Vinyl chloride	4.10	9.38	9.38		C-13
1	Torrey Canyon		N	Vinyl chloride	0.12	0.13	0.13		52.3
53	Alamont		N	Vinyl chloride	0.35	0.35	0.35		
53	Alamont		N	Vinyl chloride	0.35	0.35	0.35		
54	Arbor Hills		N	Vinyl chloride	33.0	33.0	38.3		
54	Arbor Hills		N	Vinyl chloride	6.58	6.58	6.73		
54	Arbor Hills		N	Vinyl chloride	6.58	6.64	6.74		
15	Azusa Land Reclamation		N	Vinyl chloride	2.80	3.02	2.92		2.25
15	Azusa Land Reclamation		N	Vinyl chloride	2.80	2.80	2.92		
15	Azusa Land Reclamation		N	Vinyl chloride	0.00	0.00	0.00		
15	Azusa Land Reclamation		N	Vinyl chloride	2.80	2.80	2.92		
15	Azusa Land Reclamation		N	Vinyl chloride	1.10	1.15	1.15		
15	Azusa Land Reclamation		N	Vinyl chloride	1.10	1.10	1.10		
15	Azusa Land Reclamation		N	Vinyl chloride	2.50	2.50	2.50		
15	Azusa Land Reclamation		N	Vinyl chloride	2.80	2.80	2.80		
17	Bradley Pt.		N	Vinyl chloride	13.30	13.30	17.13		12.44
17	Bradley Pt.		N	Vinyl chloride	3.20	3.20	3.03		
17	Bradley Pt.		N	Vinyl chloride	11.00	11.00	14.49		
17	Bradley Pt.		N	Vinyl chloride	4.00	4.00	5.27		
17	Bradley Pt.		N	Vinyl chloride	13.00	13.00	17.13		
17	Bradley Pt.		N	Vinyl chloride	11.00	11.00	14.49		
17	Bradley Pt.		N	Vinyl chloride	17.00	17.00	17.13		
19	Bradley Pt.		N	Vinyl chloride	20.00	20.00	20.5		
19	Bradley Pt.		N	Vinyl chloride	13.40	13.40	15.16		
19	Bradley Pt.		N	Vinyl chloride	13.00	13.00	16.1		
19	Bradley Pt.		N	Vinyl chloride	11.0	11.0	14.2		
6	Bradley Pt.		N	Vinyl chloride	0.80	0.80	1.16		
6	Bradley Pt.		N	Vinyl chloride	22.00	22.00	27.5		
6	Bradley Pt.		N	Vinyl chloride	5.00	5.00	6.79		
6	Bradley Pt.		N	Vinyl chloride	4.80	4.80	6.58		
13	Carson Pt.		N	Vinyl chloride	4.90	4.90	6.74		
13	Carson Pt.		N	Vinyl chloride	4.70	4.70	6.29		
43	CBH10		N	Vinyl chloride	2.05	2.05	2.09		2.09
43	CBH11		N	Vinyl chloride	19.0	19.0	19.2		
43	CBH12		N	Vinyl chloride	8.43	8.43	9.28		
43	CBH13		N	Vinyl chloride	6.98	6.98	12.08		
43	CBH14		N	Vinyl chloride	6.11	6.11	6.18		
43	CBH15		N	Vinyl chloride	2.70	2.70	2.73		
43	CBH17		N	Vinyl chloride	11.4	11.4	11.5		
43	CBH18		N	Vinyl chloride	10.9	10.9	11.1		
43	CBH19		N	Vinyl chloride	1.95	1.95	1.96		
43	CB22		N	Vinyl chloride	0.40	0.40	0.40		
43	CB20		N	Vinyl chloride	7.60	7.60	7.65		
43	CB21		N	Vinyl chloride	15.1	15.1	15.1		
43	CB22		N	Vinyl chloride	4.93	4.93	4.97		
43	CB23		N	Vinyl chloride	13.0	13.0	13.8		
43	CB25		N	Vinyl chloride	15.2	15.2	15.3		
43	CB26		N	Vinyl chloride	5.23	5.23	5.3		
43	CB27		N	Vinyl chloride	12.4	12.4	12.5		
43	CB30		N	Vinyl chloride	1.30	1.30	1.30		
43	CB32		N	Vinyl chloride	5.61	5.61	5.66		
43	CB33		N	Vinyl chloride	7.70	7.70	7.74		
43	CB34		N	Vinyl chloride	14.4	14.4	14.4		
43	CB4		N	Vinyl chloride	9.60	9.60	9.62		
43	CB5		N	Vinyl chloride	2.65	2.65	2.78		
43	CB6		N	Vinyl chloride	7.70	7.70	7.78		
43	CB7		N	Vinyl chloride	3.25	3.25	3.27		
43	CB8		N	Vinyl chloride	3.00	3.00	3.07		
43	CB9		N	Vinyl chloride	3.53	3.53	3.86		
43	CB10		N	Vinyl chloride	5.20	5.20	5.35		
56	Carcole Canyon		N	Vinyl chloride	1.99	1.99	1.99		
56	Coyle Canyon		N	Vinyl chloride	1.90	1.90	2.55		
56	Coyle Canyon		N	Vinyl chloride	1.84	1.84	2.45		
56	Coyle Canyon		N	Vinyl chloride	1.83	1.83	2.44		
56	Coyle Canyon		N	Vinyl chloride	2.71	2.71	2.71		
56	Coyle Canyon		N	Vinyl chloride	2.88	2.88	2.88		
57	Durham Rd.		N	Vinyl chloride	6.00	6.00	7.89		
357	Durham Rd.		N	Vinyl chloride	5.80	5.80	6.99		

\* Y=Yes, N=No, U=Unknown\*\* Values that are outlined indicate that data from only one landfill were available.

**Appendix B. Default LFG Constituent Concentrations**

Reference	Landfill Name	Co-disposal	(Y, N, or U)*	Compound	Raw Concentration (ppm)	Air Infiltration Corrected Conc. (ppm)	Site Avg.** (ppm)	Summary Statistics of [ppm]					Site Averages
								6.00	6.07	1.02	6.19	0.83	
57	Dunham Rd.			Vinyl chloride	7.14	7.14	2.68						
27	Lyon Development		U	Vinyl chloride	6.00	6.07							
27	Lyon Development		U	Vinyl chloride	5.20	5.20							
8	Operating Industries		U	Vinyl chloride	0.84	0.84							
58	Otay Annex		U	Vinyl chloride	8.80	8.80							
20	Parrose		U	Vinyl chloride	2.40	2.40							
20	Parrose		U	Vinyl chloride	0.64	0.64							
20	Parrose		U	Vinyl chloride	0.46	0.46							
20	Parrose		U	Vinyl chloride	4.40	4.40							
20	Parrose		U	Vinyl chloride	1.65	1.65							
20	Parrose		U	Vinyl chloride	7.33	7.33							
20	Parrose		U	Vinyl chloride	1.54	1.54							
20	Parrose		U	Vinyl chloride	0.65	0.65							
20	Rockingham		U	Vinyl chloride	2.39	2.39							
59	Rockingham		U	Vinyl chloride	2.30	2.30							
9	Sheldon Street		U	Vinyl chloride	22.4	22.4							
9	Sheldon Street		U	Vinyl chloride	0.08	0.08							
9	Sheldon Street		U	Vinyl chloride	0.25	0.25							
12	BKK Landfill		Y	Vinyl chloride	0.50	0.50							
12	BKK Landfill		Y	Vinyl chloride	3.98	3.98							
12	BKK Landfill		Y	Vinyl chloride	382	382							
7	Cabahitas		Y	Vinyl chloride	77.0	77.0							
7	Cabahitas		Y	Vinyl chloride	1.13	1.13							
7	Cabahitas		Y	Vinyl chloride	32.8	32.8							
43	CBH16		U	Vinyl chloride	50.0	50.0							
43	CB24		U	Vinyl chloride	50.5	50.5							
58	Otay Valley		U	Vinyl chloride	-1.00	1.02							
22	Pales Verdes		U	Vinyl chloride	16.9	16.9							
22	Pales Verdes		U	Vinyl chloride	16.4	16.4							
22	Pales Verdes		U	Vinyl chloride	2.20	2.20							
22	Pales Verdes		U	Vinyl chloride	9.59	9.59							
22	Pales Verdes		U	Vinyl chloride	2.80	2.80							
22	Pales Verdes		U	Vinyl chloride	9.59	9.59							
22	Pales Verdes		U	Vinyl chloride	3.62	3.62							
22	Pales Verdes		U	Vinyl chloride	7.85	7.85							
22	Pales Verdes		U	Vinyl chloride	0.83	0.83							
22	Pales Verdes		U	Vinyl chloride	0.58	0.58							
22	Pales Verdes		U	Vinyl chloride	4.49	4.49							
22	Pales Verdes		U	Vinyl chloride	2.10	2.10							
22	Pales Verdes		U	Vinyl chloride	2.20	2.20							
22	Pales Verdes		U	Vinyl chloride	9.59	9.59							
22	Pales Verdes		U	Vinyl chloride	2.57	2.57							
22	Pales Verdes		U	Vinyl chloride	0.59	0.59							
22	Pales Verdes		U	Vinyl chloride	2.20	2.20							
51	Pales Verdes		U	Vinyl chloride	5.67	5.67							
51	Pales Verdes		U	Vinyl chloride	2.80	2.80							
51	Pales Verdes		U	Vinyl chloride	4.35	4.35							
54	Actor Hills		U	Vinyldene chloride	0.24	0.24							
54	Actor Hills		U	Vinyldene chloride	0.24	0.24							
54	Bradley PH		U	Vinyldene chloride	32.0	32.0							
17	Bradley PH		U	Vinyldene chloride	0.30	0.30							
17	Bradley PH		U	Vinyldene chloride	12.3	12.3							
17	Bradley PH		U	Vinyldene chloride	39.2	39.2							
17	Bradley PH		U	Vinyldene chloride	2.40	2.40							
17	Bradley PH		U	Vinyldene chloride	3.16	3.16							
43	CBH10		U	Vinyldene chloride	0.10	0.10							
43	CBH11		U	Vinyldene chloride	0.65	0.66							
43	CBH12		U	Vinyldene chloride	0.05	0.06							
43	CBH13		U	Vinyldene chloride	0.08	0.08							
43	CBH14		U	Vinyldene chloride	0.23	0.23							
43	CBH17		U	Vinyldene chloride	0.15	0.15							
43	CBH18		U	Vinyldene chloride	0.18	0.18							
43	CB20		U	Vinyldene chloride	0.20	0.20							
43	CB24		U	Vinyldene chloride	0.34	0.34							
43	CB27		U	Vinyldene chloride	0.33	0.33							
43	CB4		U	Vinyldene chloride	0.37	0.37							
43	CB5		U	Vinyldene chloride	0.13	0.13							
43	CB8		U	Vinyldene chloride	0.07	0.07							
43	CB9		U	Vinyldene chloride	0.10	0.10							
55	Chirope		U	Vinyldene chloride	0.20	0.20							
56	Coyote Canyon		U	Vinyldene chloride	0.12	0.12							
56	Coyote Canyon		U	Vinyldene chloride	0.48	0.48							
56	Coyote Canyon		U	Vinyldene chloride	0.44	0.44							
56	Coyote Canyon		U	Vinyldene chloride	0.49	0.49							
56	Coyote Canyon		U	Vinyldene chloride	0.53	0.53							
56	Gardfield		U	Vinyldene chloride	0.52	0.52							
54	Actor Hills		U	Xylenes	55.8	55.8							
54	Actor Hills		U	Xylenes	64.4	64.4							
43	CBH10		U	Xylenes	51.4	52.4							
43	CBH11		U	Xylenes	4.66	4.79							
43	CBH11		U	Xylenes	10.0	10.2							
43	CBH11		U	Xylenes	12.5	12.6							

\* Y=Yes, N=No, U=Unknown\*\* Values that are outlined indicate that data from only one landfill were available.

**Appendix B. Default LFG Constituent Concentrations**

Reference	Landfill Name	Co-disposal	(Y, N, or U)*	Compound	Raw Concentration (ppm)	Air Infiltration Corrected Conc. (ppm)	Site Avg.** (ppm)	Summary Statistics of (ppm)	Site Averages
43	CB12	U	U	Xylenes	5.55	9.42	9.42	Skewness Range Maximum Sum Count	2.166 181.617 0.400 182.017 1157.579
43	CB13	U	U	Xylenes	65.0	2.50	78.6	2.50 9.88 2.94	180.400 182.017 40.000
43	CB14	U	U	Xylenes	2.90	2.94	2.94	15.6 0.45	<.01
43	CB15	U	U	Xylenes	0.46	0.45	0.45	15.6 0.45	1157.579
43	CB16	U	U	Xylenes	15.3	15.6	15.6	15.6 1.31	
43	CB17	U	U	Xylenes	0.45	0.45	0.45	1.31 37.7	
43	CB18	U	U	Xylenes	0.40	0.40	0.40	0.40 0.40	
43	CB19	U	U	Xylenes	0.30	0.30	0.30	0.30 0.30	
43	CB20	U	U	Xylenes	2.75	37.7	37.7	37.7 0.50	
43	CB21	U	U	Xylenes	0.50	0.50	0.50	0.50 13.5	
43	CB22	U	U	Xylenes	13.3	13.5	13.5	13.5 12.0	
43	CB23	U	U	Xylenes	12.0	12.7	12.7	12.7 71.8	
43	CB24	U	U	Xylenes	70.8	71.8	71.8	71.8 1.51	
43	CB26	U	U	Xylenes	4.50	4.63	4.63	4.63 4.66	
43	CB27	U	U	Xylenes	0.40	0.40	0.40	0.40 0.40	
43	CB28	U	U	Xylenes	28.7	30.4	30.4	30.4 30.4	
43	CB29	U	U	Xylenes	12.0	12.0	12.0	12.0 12.0	
43	CB3	U	U	Xylenes	70.9	71.5	71.5	71.5 71.5	
43	CB30	U	U	Xylenes	12.0	12.0	12.0	12.0 1.56	
43	CB31	U	U	Xylenes	0.55	0.55	0.55	0.55 5.56	
43	CB32	U	U	Xylenes	5.59	5.59	5.59	5.59 24.2	
43	CB33	U	U	Xylenes	24.0	24.2	24.2	24.2 0.76	
43	CB35	U	U	Xylenes	0.75	0.75	0.75	0.75 0.76	
43	CB7	U	U	Xylenes	0.75	0.75	0.75	0.75 0.76	
43	CB8	U	U	Xylenes	22.8	23.0	23.0	23.0 23.0	
43	CB9	U	U	Xylenes	12.0	12.1	12.1	12.1 53.3	
55	Chicopee	U	U	Xylenes	41.5	41.5	41.5	41.5 44.06	
56	Coyote Canyon	U	U	Xylenes	34.0	34.0	34.0	34.0 47.0	
56	Coyote Canyon	U	U	Xylenes	35.3	35.3	35.3	35.3 47.0	
56	Coyote Canyon	U	U	Xylenes	27.7	37.1	37.1	37.1 41.0	
56	Coyote Canyon	U	U	Xylenes	27.0	45.2	45.2	45.2 45.2	
56	Coyote Canyon	U	U	Xylenes	33.0	44.8	44.8	44.8 44.8	
56	Coyote Canyon	U	U	Xylenes	33.0	44.8	44.8	44.8 44.8	
51	Gila River	U	U	Xylenes	11.5	11.5	11.5	11.5 11.5	
51	Palo Verde	U	U	Xylenes	10.8	10.8	10.8	10.8 10.8	
51	Palo Verde	U	U	Xylenes	25.6	25.6	25.6	25.6 25.6	
50	Puente Hills	U	U	Xylenes	100	119	119	119 32.0	
59	Rockingham	U	U	Xylenes	98.0	24.1	24.1	24.1 32.0	
1	School Canyon	N	U	Xylenes	31.0	7.09	7.09	7.09 96.8	
60	Sunshine Canyon	U	U	Xylenes	92.0	96.8	96.8	96.8 96.8	

\* Y=Yes, N=No, U=Unknown\*\* Values that are outlined indicate that data from only one landfill were available.

## Appendix C

### Background Data for Secondary Pollutant Emission Factors and Control Efficiencies

Appendix C information is contained in the files:

SECOND.XLS (Excel) or SECOND.WK3 (Lotus) - Secondary Pollutant emission factors for flares, boilers, engines and turbines.

LFGVOC~1.XLS (Excel) or LFGVOC~1.WK3 (Lotus) - Derivation of default VOC concentrations for landfill NMOC's.

CONTRO~2.XLS (Excel) or CONTRO~2.WK3 (Lotus) - Development of default control efficiencies for flares, boilers, engines and turbines.

CHLORI~2.XLS (Excel) or CHLORI~2.WK3 (Lotus) - Derivation of Chlorine defaults.

<b>Sheet B Flare Data</b>
I5, I6, I8, I9 Inlet flow readings for these sample dates were not measured (they were calculated based on outlet concs.). I used the flow rate measured at the same point the day before for the two subsequent samples.
O11, O12 Outlet flow rate calculated based on ratio of total inlet carbon conc. and total outlet carbon conc., multiplied by the inlet flow rate (measured).
I14 Inlet flow readings for these sample dates were not measured (they were calculated based on outlet concs.). I used the flow rate measured at the same point the day before for the two subsequent samples.
O16, O17 Outlet flow rate calculated based ratio of total inlet carbon conc. and total outlet carbon conc., multiplied by the inlet flow rate (measured).
O18, O19 Outlet flow rate calculated based on ratio of total inlet carbon conc. and total outlet carbon conc., multiplied by the inlet flow rate (measured).
I21 Inlet flow readings for these sample dates were not measured (they were calculated based on outlet concs.). I used the flow rate measured at the same point the day before for the two subsequent samples.
O22, O23 Outlet flow rate calculated based on ratio of total inlet carbon conc. and total outlet carbon conc., multiplied by the inlet flow rate (measured).
O24 Outlet flow rate calculated based ratio of total inlet carbon conc. and total outlet carbon conc., multiplied by the inlet flow rate (measured).
I29, I30, I31, I36 Inlet flow readings for these sample dates were not measured (they were calculated based on outlet concs.). I used the flow rate measured at the same point the day before for the two subsequent samples.
<b>Sheet C Boiler Data</b>
I5, I6, I25 I 46 Inlet flow readings for these sample dates were not measured (they were calculated based on outlet concs.). I used the flow rate measured at the same point the day before for the two subsequent samples.
<b>Sheet D Engines</b>
H5, H6 Inlet flow readings for these sample dates were not measured (they were calculated based on outlet concs.). I used the flow rate measured at the same point the day before for the two subsequent samples.
F7 Not specified as lean burn or rich burn, described as a low-NOx supercharged design.
O7 Outlet flow rate calculated based on ratio of total inlet carbon conc. and total outlet carbon conc., multiplied by the inlet flow rate (measured).
F8 Permit specifies that engine must operate under lean burn conditions
O9 Outlet flow rate calculated based on ratio of total inlet carbon conc. and total outlet carbon conc., multiplied by the inlet flow rate (measured).
H12 Inlet flow readings for these sample dates were not measured (they were calculated based on outlet concs.). I used the flow rate measured at the same point the day before for the two subsequent samples.
F13 Not specified as lean burn or rich burn, described as a low-NOx supercharged design.
O13 Outlet flow rate calculated based on ratio of total inlet carbon conc. and total outlet carbon conc., multiplied by the inlet flow rate (measured).
F14 Permit specifies that engine must operate under lean burn conditions
O15 Outlet flow rate calculated based on ratio of total inlet carbon conc. and total outlet carbon conc., multiplied by the inlet flow rate (measured).
H16, H17 Inlet flow readings for these sample dates were not measured (they were calculated based on outlet concs.). I used the flow rate measured at the same point the day before for the two subsequent samples.
F20 Permit specifies that engine must operate under lean burn conditions
N20, N21 Values correspond to grains per scf
<b>Sheet E Turbine Data</b>
I5 Inlet flow readings for these sample dates were not measured (they were calculated based on outlet concs.). I used the flow rate measured at the same point the day before for the two subsequent samples.
I6 Inlet flow readings for these sample dates were not measured (they were calculated based on outlet concs.). I used the flow rate measured at the same point the day before for the two subsequent samples.









Summary Statistics for Emissions (kg/hr) * 1000														
Flow#12														
BID	Date	Device ID	Device ID	LFG Fuel Flow (scfm)	Methane Fraction	Orifice Rating (dscfm)	Emission Factor (kg/hr/mm³/min)	Comments						
Ref.	mo yr	Carb Monoxide	Carbon Monoxide	(m³/min)	(m³/min)	(dscfm)	(kg/hr/mm³/min)							
46	63 / 1293	A	Gas Turbine (#1)	945	0.5200	14.24	0.0167	A	EPA Method 3, Used in EF derivation					
46	63 / 8169	B	Gas Turbine (#2)	1222	0.5840	20.21	0.0194	0.0163	EPA Method 10					
46	63 / 8169	B	Gas Turbine (#2)	1032	0.5840	16.57	0.0125	0.0169	EPA Method 10					
46	63 / 8169	C	Gas Turbine (#3)	1244	0.5200	20.57	0.0129	0.0162	EPA Method 10					
66	102 / 590	C	Gas Turbine (#3)	1882	0.3395	17.80	0.0165	0.0104	Summer Data Only					
66	102 / 1290	C	Gas Turbine (#1)	1751	0.4050	20.08	0.0165	0.0165	Summer Data Only					
66	102 / 891	C	Gas Turbine (#1)	1195	0.4255	14.40	0.0165	0.0103	Summer Data Only					
66	102 / 1092	C	Gas Turbine (#1)	1522	0.4290	18.49	0.0125	0.0119	Summer Data Only					
66	102 / 903	C	Gas Turbine (#1)	1475	0.4395	18.36	0.0125	0.0141	Summer Data Only					
66	102 / 305	C	Gas Turbine (#1)	1481	0.4520	18.96	0.0185	0.0171	Summer Data Only					
66	102 / 1165	C	Gas Turbine (#1)	1902	0.4005	21.57	0.0166	0.0161	Summer Data Only					
66	102 / 903	C	Gas Turbine (#2)	1215	0.4360	15.07	0.0243	0.0121	Used in EF derivation					
66	102 / 1164	C	Gas Turbine (#2)	1311	0.4325	16.06	0.0151	0.0150	Summer Data Only					
66	102 / 1164	C	Gas Turbine (#2)	1215	0.4380	15.07	0.0242	0.0120	Used in EF derivation					
Site Average														
Site Average														
Nitrogen Oxides														
BID	Date	Device ID	Device ID	LFG Fuel Flow (scfm)	Methane Fraction	Orifice Rating (dscfm)	Emission Factor (kg/hr/mm³/min)	Comments						
Ref.	mo yr	Gas Turbine (#1)	Gas Turbine (#1)	945	0.5200	14.24	0.0165	0.0127	EPA Method 22, Used in EF derivation					
46	63 / 1293	A	Gas Turbine (#1)	1128	0.4140	13.22	0.0160	0.0140	EPA Method 20					
46	63 / 789	B	Gas Turbine (#1)	791	0.4140	9.27	0.0162	0.0192	EPA Method 20					
46	63 / 789	B	Gas Turbine (#2)	824	0.4140	9.66	0.0162	0.0182	EPA Method 20					
66	102 / 590	C	Gas Turbine (#2)	1882	0.3395	17.80	0.0165	0.0119	Summer Data Only					
66	102 / 1290	C	Gas Turbine (#1)	1751	0.4050	20.08	0.0165	0.0119	Summer Data Only					
66	102 / 891	C	Gas Turbine (#1)	1195	0.4255	14.40	0.0165	0.0119	Summer Data Only					
66	102 / 1092	C	Gas Turbine (#1)	1522	0.4290	18.49	0.0125	0.0119	Summer Data Only					
66	102 / 903	C	Gas Turbine (#1)	1475	0.4395	18.36	0.0125	0.0106	Summer Data Only					
66	102 / 305	C	Gas Turbine (#1)	1481	0.4520	18.96	0.0185	0.0118	Summer Data Only					
66	102 / 1165	C	Gas Turbine (#1)	1902	0.4005	21.57	0.0166	0.0093	Summer Data Only					
66	102 / 903	C	Gas Turbine (#2)	1215	0.4360	15.07	0.0243	0.0122	Used in EF derivation					
66	102 / 1164	C	Gas Turbine (#2)	1311	0.4325	16.06	0.0151	0.0122	Summer Data Only					
66	102 / 1164	C	Gas Turbine (#2)	1215	0.4380	15.07	0.0242	0.0120	Used in EF derivation					
Site Average														
Particulate Matter														
BID	Date	Device ID	Device ID	LFG Fuel Flow (scfm)	Methane Fraction	Orifice Rating (dscfm)	Emission Factor (kg/hr/mm³/min)	Comments						
Ref.	mo yr	Gas Turbine (#1)	Gas Turbine (#1)	1882	0.3395	17.80	0.0165	0.0113	all but 0.0004 gr/dscfm measured PM was organic					
66	102 / 1290	C	Gas Turbine (#1)	1751	0.4050	20.08	0.0165	0.0107	all measured PM was organic					
66	102 / 891	C	Gas Turbine (#1)	1522	0.4290	18.49	0.0125	0.0107	all but 0.0003 gr/dscfm measured PM was organic					
66	102 / 1092	C	Gas Turbine (#1)	1475	0.4395	18.36	0.0125	0.0100	all but 0.0002 gr/dscfm measured PM was organic					
66	102 / 903	C	Gas Turbine (#1)	1481	0.4520	18.96	0.0185	0.0093	all but 0.0001 gr/dscfm measured PM was organic					
66	102 / 1165	C	Gas Turbine (#1)	1902	0.4005	21.57	0.0166	0.0093	all measured PM was organic					
66	102 / 700	C	Gas Turbine (#2)	1398	0.4380	17.34	0.0245	0.0184	all measured PM was organic					
66	102 / 1161	C	Gas Turbine (#2)	1301	0.4360	15.07	0.0242	0.0182	all but 0.001 gr/dscfm measured PM was organic					
66	102 / 903	C	Gas Turbine (#2)	1215	0.4380	15.07	0.0242	0.0180	all but 0.001 gr/dscfm measured PM was organic					
66	102 / 1164	C	Gas Turbine (#2)	1311	0.4255	16.06	0.0151	0.0182	all measured PM was organic					
66	102 / 1164	C	Gas Turbine (#2)	1215	0.4380	15.07	0.0242	0.0180	Used in EF derivation					
Site Average														
Carbon Monoxide														
BID	Date	Device ID	Device ID	LFG Fuel Flow (scfm)	Methane Fraction	Orifice Rating (dscfm)	Emission Factor (kg/hr/mm³/min)	Comments						
Ref.	mo yr	Gas Turbine (#1)	Gas Turbine (#1)	945	0.5200	14.24	0.0167	0.0163	EPA Method 3, Used in EF derivation					
46	63 / 1293	A	Gas Turbine (#1)	1222	0.5840	20.21	0.0194	0.0169	EPA Method 10					
46	63 / 8169	B	Gas Turbine (#2)	1032	0.5840	16.57	0.0125	0.0162	EPA Method 10					
46	63 / 8169	B	Gas Turbine (#2)	1244	0.5200	20.57	0.0129	0.0162	EPA Method 10					
66	102 / 590	C	Gas Turbine (#3)	1882	0.3395	17.80	0.0165	0.0104	Summer Data Only					
66	102 / 1290	C	Gas Turbine (#1)	1751	0.4050	20.08	0.0165	0.0165	Summer Data Only					
66	102 / 891	C	Gas Turbine (#1)	1195	0.4255	14.40	0.0165	0.0103	Summer Data Only					
66	102 / 1092	C	Gas Turbine (#1)	1522	0.4290	18.49	0.0125	0.0119	Summer Data Only					
66	102 / 903	C	Gas Turbine (#1)	1475	0.4395	18.36	0.0125	0.0106	Summer Data Only					
66	102 / 305	C	Gas Turbine (#1)	1481	0.4520	18.96	0.0185	0.0171	Summer Data Only					
66	102 / 1165	C	Gas Turbine (#1)	1902	0.4005	21.57	0.0166	0.0161	Summer Data Only					
66	102 / 903	C	Gas Turbine (#2)	1215	0.4360	15.07	0.0243	0.0121	Used in EF derivation					
66	102 / 1164	C	Gas Turbine (#2)	1311	0.4325	16.06	0.0151	0.0161	Summer Data Only					
66	102 / 1164	C	Gas Turbine (#2)	1215	0.4380	15.07	0.0242	0.0120	Used in EF derivation					
Site Average														
Oxides of Nitrogen														
BID	Date	Device ID	Device ID	LFG Fuel Flow (scfm)	Methane Fraction	Orifice Rating (dscfm)	Emission Factor (kg/hr/mm³/min)	Comments						
Ref.	mo yr	Gas Turbine (#1)	Gas Turbine (#1)	945	0.5200	14.24	0.0167	0.0163	EPA Method 3, Used in EF derivation					
46	63 / 1293	A	Gas Turbine (#1)	1222	0.5840	20.21	0.0194	0.0169	EPA Method 10					
46	63 / 8169	B	Gas Turbine (#2)	1032	0.5840	16.57	0.0125	0.0162	EPA Method 10					
46	63 / 8169	B	Gas Turbine (#2)	1244	0.5200	20.57	0.0129	0.0162	EPA Method 10					
66	102 / 590	C	Gas Turbine (#3)	1882	0.3395	17.80	0.0165	0.0104	Summer Data Only					
66	102 / 1290	C	Gas Turbine (#1)	1751	0.4050	20.08	0.0165	0.0165	Summer Data Only					
66	102 / 891	C	Gas Turbine (#1)	1195	0.4255	14.40	0.0165	0.0103	Summer Data Only					
66	102 / 1092	C	Gas Turbine (#1)	1522	0.4290	18.49	0.0125	0.0119	Summer Data Only					
66	102 / 903	C	Gas Turbine (#1)	1475	0.4395	18.36	0.0125	0.0106	Summer Data Only					
66	102 / 305	C	Gas Turbine (#1)	1481	0.4520	18.96	0.0185	0.0171	Summer Data Only					
66	102 / 1165	C	Gas Turbine (#1)	1902	0.4005	21.57	0.0166	0.0161	Summer Data Only					
66	102 / 903	C	Gas Turbine (#2)	1215	0.4360	15.07	0.0243	0.0121	Used in EF derivation					
66	102 / 1164	C	Gas Turbine (#2)	1311	0.4325	16.06	0.0151	0.0161	Summer Data Only					
66	102 / 1164	C	Gas Turbine (#2)	1215	0.4380	15.07	0.0242	0.0120	Used in EF derivation					
Site Average														
Carbon Monoxide														
BID	Date	Device ID	Device ID	LFG Fuel Flow (scfm)	Methane Fraction	Orifice Rating (dscfm)	Emission Factor (kg/hr/mm³/min)	Comments						
Ref.	mo yr	Gas Turbine (#1)	Gas Turbine (#1)	945	0.5200	14.24	0.0167	0.0163	EPA Method 3, Used in EF derivation					
46	63 / 1293	A	Gas Turbine (#1)	1222	0.5840	20.21	0.0194	0.0169	EPA Method 10					
46	63 / 8169	B	Gas Turbine (#2)	1032	0.5840	16.57	0.0125	0.0162	EPA Method 10					
46	63 / 8169	B	Gas Turbine (#2)	1244	0.5200	20.57	0.0129	0.0162	EPA Method 10					
66	102 / 590	C	Gas Turbine (#3)	1882	0.3395	17.80	0.0165	0.0104	Summer Data Only					
66	102 / 1290	C	Gas Turbine (#1)	1751	0.4050	20.08	0.0165	0.0165	Summer Data Only					
66	102 / 891	C	Gas Turbine (#1)	1195	0.4255	14.40	0.0165	0.0103	Summer Data Only					
66	102 / 1092	C	Gas Turbine (#1)	1522	0.4290	18.49	0.0125	0.0119	Summer Data Only					
66	102 / 903	C	Gas Turbine (#1)	1475	0.4395	18.36	0.0125	0.0106	Summer Data Only					
66	102 / 305	C	Gas Turbine (#1)	1481	0.4520	18.96	0.0185	0.0171	Summer Data Only					
66														

BID	AP-42 Ref.	Date 5/6/91	Landfill Name Coyote Canyon	Control/Utilization Boiler	Compound	Molecular Weight	^ v	Control Efficiency	EF Rating	Comments
56	39			TGNMIO (as hexane)		86	=	95.89%	C	Lacking Backup Data
				Benzene	78.12		=	67.29%	C	data point excluded
				1,2-Dichlorobenzene	98.96		=	86.52%	C	
				Perchloroethylene	165.83		=	97.42%	C	
				Toluene	92.13		=	97.59%	C	
				Xylenes	106.16		=	99.21%	C	
				Avg. Non-Halo.				91.97%		
				Avg. Halo.				88.03%		
				Benzene	78.12		=	99.79%	D	
				Toluene	92.13		=	99.93%	D	
				Xylenes	106.16		=	99.93%	D	
				Perchloroethylene	165.83		=	99.88%	D	Lacking Backup Data; CE is >99.93
				Methylene Chloride	84.94		=	99.96%	D	Lacking Backup Data; CE is >99.75
				Dichlorobenzene	98.96		=	99.87%	D	Lacking Backup Data; CE is >99.95
				Average	78.12		=	99.93%	D	
				Benzene	92.13		=	99.86%	D	
				Toluene	106.16		=	99.90%	D	
				Xylenes	165.83		=	99.97%	D	Lacking Backup Data; CE is >99.95
				Perchloroethylene	84.94		=	99.91%	D	
				Methylene Chloride	98.96		=	99.81%	D	
				Dichlorobenzene	ND			99.40%	D	
				Average	86		=	66.41%	ND	Lacking Backup Data
				Benzene	78.12		=	99.08%	D	
				Toluene	92.13		=	99.99%	D	
				Xylenes	106.16		=	99.99%	D	
				Average	165.83		=	99.99%	D	
				Perchloroethylene	84.94		=	99.90%	D	Lacking Backup Data; CE is >99.80
				Methylene Chloride	98.96		=	99.79%	D	Lacking Backup Data; CE is >99.59
				Dichlorobenzene	ND			99.97%	D	Lacking Backup Data; CE is >99.94
				Average	86		=	99.89%	D	Lacking Backup Data; CE is >99.83
				TGNMIO (as hexane)				99.83%	D	
				Benzene				99.46%	D	
				Toluene				99.02%	D	
				Xylenes				99.95%	D	
				Average	78.12		=	99.90%	D	Lacking Backup Data; CE is >99.69
				Benzene	92.13		=	99.90%	D	Lacking Backup Data; CE is >99.69
				Toluene	106.16		=	99.96%	D	Lacking Backup Data; CE is >99.78
				Xylenes	165.83		=	99.91%	D	Lacking Backup Data; CE is >99.29%
				Perchloroethylene	84.94		=	98.90%	D	
				Methylene Chloride	98.96		=	98.29%	D	
				Dichlorobenzene	ND			99.88%	D	
				Average	86		=	99.02%	D	
				Benzene	78.12		=	99.36%	D	
				Toluene	92.13		=	99.99%	D	
				Xylenes	106.16		=	100.00%	D	Lacking Backup Data; CE is >99.99
				Perchloroethylene	165.83		=	99.78%	D	
				Methylene Chloride	84.94		=	99.99%	D	Lacking Backup Data; CE is >99.98
				Dichlorobenzene	98.96		=	100.00%	D	Lacking Backup Data; CE is >100.00
				Average	86		=	66.66%	ND	
				TNMHC (as hexane)				99.42%	D	
				TNMHC (as hexane)				99.37%	D	
				Benzene				99.67%	D	
				Toluene				99.72%	D	
				Xylenes				94.99%	D	
				Average	86		=	98.64%	D	
				Benzene				98.00%		
				Toluene				87.31%		
				Xylenes				97.92%		
				Avg. Non-Halo CE						
				Avg. Halo CE						
				Overall Boiler Average NMOC CE						
				Overall Boiler Non-Halo CE						

BID	AP-42 Ref.	Date	Landfill Name	Control/Utilization	Compound	Molecular Weight	> Efficiency	EF Rating	Comments
102	68	5/90	Puente Hills	Gas Turbine (#1)	Average	0.00%			
102	68	9/93	Puente Hills	Gas Turbine (#2)	Average	0.00%			
102	68	11/91	Puente Hills	Gas Turbine (#1)	Benzene	78.12	=	99.07%	D
102	68	7/90	Puente Hills	Gas Turbine (#2)	Benzene	78.12	=	97.48%	D
102	68	9/93	Puente Hills	Gas Turbine (#2)	Benzene	78.12	=	98.28%	D
102	68	11/94	Puente Hills	Gas Turbine (#2)	Benzene	78.12	=	96.88%	D
102	68	9/93	Puente Hills	Gas Turbine (#2)	Benzene	78.12	=	96.56%	D
102	68	11/94	Puente Hills	Gas Turbine (#2)	Benzene	78.12	=	97.55%	D
102	68	9/93	Puente Hills	Gas Turbine (#2)	Benzene	78.12	=	98.39%	D
102	68	3/95	Puente Hills	Gas Turbine (#1)	Dichlorobenzene	98.96	=	97.81%	
102	68	9/93	Puente Hills	Gas Turbine (#2)	Dichlorobenzene	98.96	>	98.35%	D
102	68	11/91	Puente Hills	Gas Turbine (#2)	Methylene Chloride	84.94	>	99.89%	D
102	68	8/91	Puente Hills	Gas Turbine (#1)	Methylene Chloride	106.16	=	99.12%	D
102	68	10/92	Puente Hills	Gas Turbine (#2)	Methylene Chloride	84.94	>	99.97%	D
102	68	11/91	Puente Hills	Gas Turbine (#2)	Methylene Chloride	84.94	=	99.91%	D
102	68	9/93	Puente Hills	Gas Turbine (#1)	Perchloroethylene	165.83	>	99.58%	
102	68	9/93	Puente Hills	Gas Turbine (#2)	Perchloroethylene	165.83	=	99.95%	D
102	68	3/95	Puente Hills	Gas Turbine (#1)	TGNMO (as hexane)	86	=	99.57%	D
102	68	11/95	Puente Hills	Gas Turbine (#1)	TGNMO (as hexane)	86	>	99.32%	D
102	68	5/90	Puente Hills	Gas Turbine (#1)	TGNMO (as hexane)	86	=	99.03%	D
102	68	12/90	Puente Hills	Gas Turbine (#1)	TNMHC (as hexane)	86	>	99.55%	D
102	68	8/91	Puente Hills	Gas Turbine (#1)	TNMHC (as hexane)	86	=	94.75%	D
102	68	10/92	Puente Hills	Gas Turbine (#1)	TNMHC (as hexane)	86	=	96.77%	D
102	68	11/91	Puente Hills	Gas Turbine (#2)	TNMHC (as hexane)	86	=	95.86%	D
102	68	9/93	Puente Hills	Gas Turbine (#2)	TNMHC (as hexane)	86	=	97.26%	D
102	68	11/91	Puente Hills	Gas Turbine (#2)	TGNMO (as hexane)	86	=	90.09%	D
102	68	9/93	Puente Hills	Gas Turbine (#1)	Toluene	92.13	=	92.93%	D
102	68	12/90	Puente Hills	Gas Turbine (#1)	Toluene	92.13	=	91.51%	D
102	68	8/91	Puente Hills	Gas Turbine (#1)	Toluene	92.13	=	95.62%	D
102	68	10/92	Puente Hills	Gas Turbine (#1)	Toluene	92.13	=	99.92%	D
102	68	11/91	Puente Hills	Gas Turbine (#2)	Toluene	92.13	=	99.89%	D
102	68	9/93	Puente Hills	Gas Turbine (#2)	Vinyl Chloride	62.5	=	98.87%	D
102	68	10/92	Puente Hills	Gas Turbine (#1)	Xylenes	106.16	=	99.06%	D
102	68	11/91	Puente Hills	Gas Turbine (#1)	Xylenes	106.16	=	99.12%	D
102	68	10/92	Puente Hills	Gas Turbine (#2)	Xylenes	106.16	=	99.42%	D
102	68	11/91	Puente Hills	Gas Turbine (#2)	Xylenes	106.16	=	99.97%	D
102	68	9/93	Puente Hills	Gas Turbine (#1)	halo	Average		99.17%	
102	68	9/93	Puente Hills	Gas Turbine (#1)	nonhalo	Average		98.76%	
102	68	11/91	Puente Hills	Gas Turbine (#2)	halo	Average		99.34%	
102	68	8/91	Puente Hills	Gas Turbine (#2)	nonhalo	Average		98.75%	
102	68	10/92	Puente Hills	Gas Turbine (#2)	halo	Average		99.26%	
102	68	11/91	Puente Hills	Gas Turbine (#1)	nonhalo	Average		98.77%	
102	68	9/93	Puente Hills	Gas Turbine (#1)	NMOC	Average		94.39%	

NOTES: NOTE: For the LACSD Ref. 102 data, only CE data for which detectable concs. at the inlet are presented (for non-detects at the exhaust 0.5 x the detect limits are assumed). Multiple data points were used for compounds where a wide range of CEs were observed (i.e., >1.0%).

BID	Date	Device ID	Compound	Average (%)	D.E. (%)	Average (%)	Site	Comments
Ref.	mo/yr	NMOC		>	<	>	>	Column1
102	3/92	A	Flare (#1)	=	99.40	99.40	99.28	
102	2/91	A	Flare (#3)	=	99.97	99.97		
102	10/91	A	Flare (#4)	=	97.27	98.60		
102	5/96	A	Flare (#4)	>	99.92			
102	12/94	A	Flare (#5)	>	99.80	99.85		
102	9/90	A	Flare (#5)	>	99.90			
102	11/93	A	Flare (#6)	=	97.37	98.58		
102	9/90	A	Flare (#6)	=	99.78			
102	8/92	B	Flare (#1)	=	99.48	99.65	99.09	
102	9/94	B	Flare (#1)	=	99.66			
102	5/96	B	Flare (#1)	=	99.80			
102	7/90	B	Flare (#2)	=	99.67	99.26		
102	7/93	B	Flare (#2)	=	98.30			
102	5/96	B	Flare (#2)	=	99.80			
102	8/92	B	Flare (#3)	=	98.73	99.18		
102	6/95	B	Flare (#3)	=	99.63			
102	8/92	B	Flare (#4)	=	99.23	99.44		
102	6/95	B	Flare (#4)	=	99.64			
102	7/90	B	Flare (#5)	=	99.56	99.01		
102	7/93	B	Flare (#5)	=	97.80			
102	6/95	B	Flare (#5)	=	99.67			
102	8/92	B	Flare (#6)	=	99.41	99.54		
102	6/95	B	Flare (#6)	=	99.66			
102	7/93	B	Flare (#7)	=	97.30	98.50		
102	5/96	B	Flare (#7)	=	99.70			
102	11/91	B	Flare (#9)	=	98.29	98.57		
102	9/94	B	Flare (#9)	=	98.84			
102	11/91	B	Flare (#10)	=	98.98	99.23		
102	11/94	B	Flare (#10)	=	99.47			
102	9/94	B	Flare (#11)	=	99.40	99.40		
102	11/91	B	Flare (#12)	=	98.20	98.27		
102	7/93	B	Flare (#12)	=	96.90			
102	5/96	B	Flare (#12)	=	99.70			
102	1/94	C	Flare (#1)	=	98.90	98.90	99.33	
102	10/91	C	Flare (#2)	=	99.15	99.38		
102	2/92	C	Flare (#2)	=	99.20			
102	5/95	C	Flare (#2)	=	99.80	99.60	99.70	
102	2/92	C	Flare (#3)	=	99.80			
102	5/95	C	Flare (#3)	=	99.79	99.39		
102	1/94	C	Flare (#5)	=	98.99			
102	10/91	C	Flare (#6)	=	99.21	99.26		
102	3/93	C	Flare (#6)	=	99.06			

C	Flare (#6)	99.50		99.45		99.31
D	Flare (#1)	99.20	=	99.20	=	
D	Flare (#1)	99.70	>	99.70	>	
D	Flare (#2)	97.10	=	97.10	=	
D	Flare (#2)	99.42	=	99.42	=	
D	Flare (#3)	99.50	=	99.50	=	
D	Flare (#3)	99.50	=	99.50	=	
D	Flare (#3)	99.70	>	99.70	>	
D	Flare (#4)	99.99	>	99.99	>	
D	Flare (#4)	99.50	=	99.50	=	
D	Flare (#4)	99.50	=	99.50	=	
D	Flare (#5)	99.20	=	99.20	=	
D	Flare (#5)	99.10	=	99.10	=	
D	Flare (#6)	99.70	>	99.70	>	
D	Flare (#6)	98.80	=	98.80	=	
D	Flare (#6)	99.78	=	99.78	=	
D	Flare (#7)	99.93	>	99.93	>	
D	Flare (#7)	99.54	=	99.54	=	
D	Flare (#8)	99.84	=	99.84	=	
D	Flare (#9)	99.84	=	99.84	=	
E	Flare (#2)	99.66	>	99.66	>	
E	Flare (#2)	98.56	=	98.56	=	
E	Flare (#2)	94.10	=	94.10	=	
E	Flare (#3)	99.75	>	99.75	>	
E	Flare (#3)	98.90	=	98.90	=	
E	Flare (#4)	99.69	>	99.69	>	
E	Flare (#4)	96.57	=	96.57	=	
E	Flare (#4)	93.80	=	93.80	=	
E	Flare (#5)	99.01	=	99.01	=	
E	Flare (#5)	98.40	=	98.40	=	
E	Flare (#6)	99.21	=	99.21	=	
E	Flare (#6)	98.50	=	98.50	=	
E	Flare (#6)	99.59	=	99.59	=	
E	Flare (#7)	99.36	=	99.36	=	
E	Flare (#7)	97.70	=	97.70	=	
E	Flare (#8)	97.18	=	97.18	=	
E	Flare (#8)	99.50	>	99.50	>	
E	Flare (#9)	99.60	=	99.60	=	
E	Flare (#9)	98.00	=	98.00	=	
E	Flare (#10)	99.66	>	99.66	>	
E	Flare (#10)	98.90	=	98.90	=	
E	Flare (#10)	99.56	=	99.56	=	
E	Flare (#11)	99.71	>	99.71	>	
E	Flare (#11)	99.21	=	99.21	=	
E	Flare (#11)	99.46	>	99.46	>	
E	Flare (#12)	99.65	=	99.65	=	
E	Flare (#12)	99.50	=	99.50	=	



				Xylenes	Average >	99.94	Lacking Backup Data.
				Perchloroethylene =	99.96		
				Methylene Chloric >	99.98	Lacking Backup Data.	
				Dichlorobenzene >	99.04	Lacking Backup Data.	
102	2/92	C	Flare (#3)	Benzene Average	> 99.90		
				Toluene >	99.90	Lacking Backup Data.	
				Xylenes Average	> 99.90	Lacking Backup Data.	
				Perchloroethylene >	99.90	Lacking Backup Data.	
				Methylene Chloric >	99.90	Lacking Backup Data.	
				Dichlorobenzene N/A		Inlet and outlet concentrations were not detected.	
102	2/92	D	Flare (#4)	Benzene Average	> 99.51		
				Toluene >	99.98	Lacking Backup Data.	
				Xylenes >	99.98	Lacking Backup Data.	
				Perchloroethylene =	99.92	Lacking Backup Data.	
				Methylene Chloric >	99.99	Lacking Backup Data.	
				Dichlorobenzene >	99.22	Lacking Backup Data.	
5/90	E	Flare (#9)		Benzene Average	= 99.57		
				Toluene =	99.86	Lacking Backup Data.	
				Xylenes >	99.88	Lacking Backup Data.	
				Perchloroethylene =	99.89	Lacking Backup Data.	
				Methylene Chloric >	99.96	Lacking Backup Data.	
				Dichlorobenzene >	99.23	Lacking Backup Data.	
				Average	> 62.07		
3&4/1992	L	Flare		Benzene	= 38.20		
				Toluene	n/a		
				Xylenes	n/a		
				Average	not calculated		
				Perchloroethylene >	94.40		
				Methylene Chloric =	91.80		
				Dichlorobenzene n/a			
				Average >	62.07		
3&4/1992	M	Flare		Benzene	= 85.90		
				Toluene	n/a		
				Xylenes	n/a		
				Average =	28.63		
				Perchloroethylene >	98.40		
				Methylene Chloric >	90.50		

		Dichlorobenzene	n/a
		Average	> 62.97
8/90	N	Flare	
		Benzene	> 98.72
		Toluene	= 99.94
		Xylenes	> 99.89
		Average	= 99.52
		Perchloroethylene	> 98.17
		Methylene Chloride	n/a
		Dichlorobenzene	n/a
		Average	> 32.72
	O	Flare	
		Benzene	> 83.40
		Toluene	= 99.80
		Xylenes	> 99.40
		Average	> 94.20
		Perchloroethylene	> 98.90
		Methylene Chloride	n/a
		Dichlorobenzene	n/a
		Average	> 32.97
		test results not used (-73% DE)	
		test results not used (-54% DE)	

BID	Date	Device ID	CE	Average CE (%)	EF Rating	Comments
Ref.	mo/yr	IC Engine	Compound			
98	Dec-90	IC Engine	Methane	97.80	B	
			Ethane	98.33	B	
			Propane	90.46	B	
			Butane	94.53	B	
			Pentane	98.34	B	
			NMOC	97.13	B	
99	Apr-91	IC Engine	NMOC	94.59	C	
100	Feb-88	IC Engine	NMOC	99.74	D	
			Trichloroethylene	98.93	D	
			Perchloroethylene	99.41	D	
			Methane	94.06	D	
101	Mar-88	IC Engine	Benzene	25.00	D	data point excluded
			Toluene	96.67	D	
			Xylene	99.22	D	
			Trichloroethylene	94.00	D	
			1,1,1-Trichloroethylene	90.00	D	
			Perchloroethylene	95.00	D	
			Methane	62.12	D	
			Avg. NMOC	97.15		
			Avg. All (non-methane) Species	89.99		
			Avg. Halo Species	95.47		
			Avg. Non-Halo Species	86.08		

## DERIVATION OF CHLORIDE CONTENT

Compound	Molecular Weight	Default Concentration (ppmv)	Moles of Chloride Produced	Individual Chloride Concentrations
1,1,1-Trichloroethane (methyl chloroform)*	133.42	0.48	3	0.38
1,1,2,2-Tetrachloroethane*	167.85	1.11	4	0.93
1,1,2-Trichloroethane*	133.42	0.10	3	0.08
1,1-Dichloroethane (ethylidene dichloride)*	98.95	2.35	2	1.66
1,1-Dichloroethene (vinylidene chloride)*	96.94	0.20	2	0.14
1,2-Dichloroethane (ethylene dichloride)*	98.96	0.41	2	0.29
1,2-Dichloropropane (propylene dichloride)*	112.98	0.18	2	0.11
Bromodichloromethane	163.87	3.13	2	1.34
Carbon tetrachloride*	153.84	0.004	4	0.004
Chlorobenzene*	112.56	0.25	1	0.08
Chlorodifluoromethane	86.47	1.30	1	0.53
Chloroethane	64.52	1.25	1	0.68
Chloroform*	119.39	0.04	3	0.04
Chloromethane	50.49	1.21	1	0.84
Dichlorobenzene**	147.00	0.21	2	0.10
Dichlorodifluoromethane	120.91	15.70	2	9.09
Dichlorofluoromethane	102.92	2.62	2	1.78
Dichloromethane	84.94	14.30	2	11.78
Fluorotrichloromethane	137.38	0.76	3	0.58
Perchloroethylene (tetrachloroethylene)*	165.83	3.73	4	3.15
Trichloroethylene (trichloroethene)*	131.40	2.82	3	2.25
t-1,2-dichloroethene	96.94	2.84	2	2.05
Vinyl chloride*	62.50	7.34	1	4.11
Total Chloride Concentration				41.99

AP-42 Section 2.4 - Municipal Solid Waste Landfills  
Section and Background document information

The file b02s04.zip, located on the CD under \programs\misc\, contains the original files that were used to create the final AP-42 section and Background report for Municipal Waste Landfills for Revision Dated September 1997. Much of the information contained in the following files are presented in the Adobe Acrobat versions of these reports. However, users wishing additional detail can use the spreadsheet files to understand the factor development more thoroughly and to perform additional analysis with the data or additional data where available. The following files are contained in the compressed zip file.

C02S04.WP6  
Revised AP-42 Section for Municipal Solid Waste Landfills in WordPerfect 6.1 for Windows format.

B02S04.WP6  
Background Report for Landfill Section (Does not include Appendices) in WordPerfect 6.1 for Windows.

APPXAX~.XLS  
APPXAX~.WK3  
Appendix A, Summary of all Landfill test report data in Excel version 5 (XLS) and Lotus 1-2-3 (WK3) format.

LFBKAPPB.XLS  
LFBKAPPB.WK3  
Appendix B, Background Data for Default LFG Concentrations in Excel version 5 and Lotus 1-2-3 (WK3) format.

CONTRO~2.XLS  
CONTRO~2.WK3  
Appendix C, Control Efficiencies information in Excel version 5 and Lotus 1-2-3 (WK3) format.

CHLORI~1.XLS  
CHLORI~1.WK3  
Appendix C, Derivation of Chlorine Defaults in Excel version 5 and Lotus 1-2-3 (WK3) format.

LFGVOC~1.XLS  
LFGVOC~1.WK3  
Appendix C, Derivation of Default VOC concentrations in Excel version 5 and Lotus 1-2-3 (WK3) format.

SECOND.XLS  
SECOND.WK3  
Appendix C, Secondary pollutant emission factors for flares, boilers, engines and turbines in Excel version 5 and Lotus 1-2-3 (WK3) format.

TECHMEMO.WP6  
Technical memorandum in WordPerfect 6.1 for Windows format.

TECH-ABS.WP6  
Technical abstract in WordPerfect 6.1 for Windows format.

??????????.CGM  
Graphics in CGM format.

??.??.??.??.??.??.DRW  
Graphics in WordPerfect Draw format.

COVER.LTR  
Cover letter for External Review of Section.

LANDFILL.ADD  
Address list of External Reviewers.